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Abhijit Gupta, School of Computer Science & IT Singhania University Rajasthan, India

Subarna Shakya, Department of Electronics and Computer Engineering, Institute of Engineering, Tribhuvan University, Kathmandu, Nepal

Abstract — Life can be made better and easier with the growing information and communication technology. Efficient Software and Hardware together play a vital role giving relevant information which helps improving ways we do business, learn, communicate, entertain and work. This exposes to an environment with significant risks which are vulnerable to inside or outside attacks. System audit, thus, becomes important and is a key process to assure security, reliability and our dependency on such systems. The information system audit for security can increase the chances of adopting sufficient preventive and security measures for prevention or lowering of consequences. This paper is prepared upon exploration and studies on information system security and challenges in Nepal. Data is collected by online survey and the analysis of data helps to explore its current status of security and challenges for Information System Audit in Nepal.

Keywords— *Information System; IS Audit; System Audit; Security; Challenges; Risks;*

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Dr. Andrew Lawrence Norton, Durham Business School, Durham University, UK

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Keywords: *Enterprise resource planning; ERP II implementation; critical success factors; CSF phasing; critical pathway steps; CRM*

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Ameen Alawneh, Department of Mathematics, Statistics and Physics, Qatar University, Doha - Qatar

Ahmad Dalalah & Ibrahim Faraj, Department of Computer Science, Jordan University of Science & Technology, Irbid - Jordan

Abstract — A Mobile ad-hoc network (MANET) is a collection of wireless mobile hosts that dynamically form a temporary network without the aid of a system administrator. It has neither fixed infrastructure nor wireless ad hoc sessions. It inherently reaches several nodes with a single transmission, and each node functions as both a host and a router. The network maybe represented as a set of clusters each managed by clusterhead. The cluster size is not fixed and depends on the movement of nodes. We proposed a clusterhead size algorithm (CHSize). This clustering algorithm can be used by several routing algorithms for ad hoc networks. An elected clusterhead is assigned for communication with all other clusters. Analysis and simulation of the algorithm has been implemented using GloMoSim networks simulator, MATLAB and MAPL11 proved that the proposed algorithm achieves the goals.

Keywords- simulation, MANET, Ad-hoc, Cluster head size, Linked cluster algorithm, loss and dropped packets.

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Godphrey G. Kyambille, Computation and Communication Science &Engineering, Nelson Mandela African Institution of Science and Tech, Arusha, Tanzania

Khamisi Kalegele, Computation and Communication Science &Engineering, Nelson Mandela African Institution of Science and Tech, Arusha, Tanzania

Abstract — Appointment scheduling systems are utilized mainly by specialty care clinics to manage access to service providers as well as by hospitals to schedule patient appointments. When attending hospitals in Tanzania, patients experience challenges to see an appropriate specialist doctor because of service interval inconsistency. Timely availability of doctors is critical whenever a patient needs to see a specialist doctor for treatment and a serious bottleneck lies in the application of appropriate technology techniques to enhance appointment scheduling. In this paper, we present a mobile based application scheduling system for managing patient appointments. Furthermore, forthcoming opportunities for the innovative use of the mobile based application scheduling system are identified.

Keywords: *Mobile application, Hospital, Appointment scheduling, Patient.*

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*Ssegawa Andrew Kiggundu, Department of computer science, Nkumba University, Entebbe - Uganda
Ezekiel Uzor Okike, Department of computer science, University of Botswana, Gaborone, Botswana*

Abstract — This paper presents an architectural framework to facilitate the development of an information system for Population Registration and National Identification System (PRNIS). A fully automated system of population registration which is amenable to the local needs of Uganda has not yet been implemented. The objective of this paper is to provide an architectural design model for the comprehensive, continuous, permanent and compulsory registration and identification of citizens and non-citizens in Uganda. Data used in developing this architectural framework for PRNIS was collected through interviews, observation and secondary sources. The study created an architectural model which can be used to develop a system for continuous registration of events, ascertainment of accurate statistics for population, provide proof of identity of citizens and create a repository for vital statistics in Uganda.

Keywords — *Architecture; population; national registration; identification system; vital statistics; data modeling*

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N. Khodeir, Dep. of Informatics research, Electronic Research Institute, Giza, Egypt

Abstract — Language Tutoring Systems (LTSs) are computer based tutoring systems that concerned with learning languages. Most of LTSs are based on natural language processing tools for analyzing the student response to support him/her with suitable feedback. However, such systems (especially for Arabic language) don't consider modeling of the student knowledge. Therefore, these systems cannot personalize their interactions to each student needs and preferences. This paper presents a technique for modeling the student competence in Arabic language skills. Arabic language skills for grade four in primary stage are addressed. We defined and sorted these skills according to their difficulties. In addition, a number of domain constraints are defined where the student answer to system presented questions are tested against them. Satisfied and violated constraints are used to model the student

competence in the selected domain skills. The student model can be used to adapt the system interactions according to the student week points to enhance his/her Arabic language skills.

Keywords - Intelligent Tutoring Systems; Intelligent language Tutoring Systems; Constraint Based Student Modeling.

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Hanan Ali †, Ming Ouyang ‡, Amira Soliman †, Walaa Sheta †

† Informatics Research Institute City of Scientific Research and Technological Applications New Borg El-Arab, Alexandria, Egypt

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Abstract — A linear feedback shift register has the property that its input bit is a linear function of its current state. It has many applications, such as cryptography and digital signal processing. The Berlekamp-Massey algorithm finds a shortest linear feedback shift register that generates the input binary sequence. If the length of the input is n, the algorithm takes $O(n^2)$ time. Various issues in serial implementation as well as parallel implementation of the algorithm are studied. A well-designed serial code can be up to 37.8 times faster than a typical implementation, and a CUDA implementation can deliver additionally 12.7 times speedup.

Keywords - component; Berlekamp-Massey algorithm, linear feedback shift register, parallel computing, graphics processing unit formatting.

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Mohamed HANAOUI, Hamid BOUASSAM, Mounir RIFI, Hanae TERCHOUNE

CED Engineering Science, ENSEM, Lab. RITM/ESTC Hassan II University Casablanca, Morocco

Abstract — This paper presents a smart antenna system for BTS application. The proposed antenna is an antenna array, composed from three dipoles spatially separated antennas, and it's able to estimate the direction of arrival (DOA), directing the radiation pattern towards the desired user to allow significant energy saving. This article discusses advantages of this system for base transceiver station highlights improvements that are possible by using different delay lines. The comparison between measurement results and simulation results are provided to validate the model.

Keywords - component; smart antenna, radiation pattern, gain, power density, energy efficiency, antenna array, delay line, DOA

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Rachid AOUAMI, Mounir RIFI

Lab RITM.ESTC .CED Engineering Science, ENSEM, University of Casablanca, Morocco

Abstract — This paper presents a simple approximation mathematical model of fountain code-enabled distribution coordination function to calculate the throughput for the ideal condition of IEEE802.11 using the request to send/clear to send of four-way handshaking technique. This estimation introduces a new linear approximation model that reduces the complexity of the nonlinear of the analytical model. However, the resolution of non-linear system and performance modeling analysis of the IEEE 802.11 network in all its various extensions have been the subject of several studies. Because the analytical results for these non-linear models are difficult to verify and some equations are given without clear proof. This analysis is validated by comparison with simulation results using Matlab.

Keywords — Mathematical Analysis, Wireless Sensor Network, Fountain Code, Throughput, Markov Chain.

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*Abou_el_ela Abdo Hussien, Department of Computer Science, Faculty of Science and Arts, Shaqra University, KSA
Nagy Ramadan Darwish, Department of Computer and Information Sciences, Institute of Statistical Studies and Research, Cairo University*

Abstract — This paper aims to provide enhancements in the privacy preserving model that was published in our previous paper entitled "An Effective Privacy Preserving Model for Databases Using (α, β, k) - Anonymity Model and Lossy Join" [1]. The previous paper includes a model that maintains the privacy of the multiple sensitive data after the publication of the data in two tables: one for QI-tuples and the other for sensitive attributes. This model used the connecting numbers which depend on one of the sensitive attributes as in lossy join technique. The authors found that in some cases there is a problem may arise with retrieving the exact frequency for any of the rest sensitive attributes if they are not included, as a set of attributes in the same tuple in sensitive attributes table. In other words, the frequency of any one of the rest sensitive attributes is different from the existing frequency of the same attribute in original table especially if the researcher doesn't use all sensitive attributes in the same tuple together as a set. This problem may affect the ability of researchers to utilize the data and consequently affect the research accuracy. This paper proposed a solution for this problem by adding the frequency details in published sensitive data table for the sensitive attributes that are not used in making connecting numbers. The solution will increase the data utility and improve the research accuracy.

Index Terms—Privacy Preserving Model, Anatomy Technique, lossy join, Multiple Sensitive Attributes, Connecting Numbers.

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Dipo T. Akomolafe, Dept. of Mathematical Sciences, Ondo State University of Science and Technology, Okitipupa, Nigeria

Abstract - Recently in Nigeria, the CBN came up with a gradual introduction of cash-less policy and this have constituted a controversial subject of debate at different levels of discussions and consequently becoming an interesting area of research. In this research, a Cashless Society is viewed as a society in which plastic money or any other technology that supports virtual transfer of money for goods purchased or services rendered are the sole modes of payment rather than as a society that operates the trade by barter system as the sole means of payment. The policy thrust of cashless policy centers on the use of electronic system for payment for goods and services instead of the presently used paper money. The successful realization of the policy thrust of cashless society rest entirely on the financial services rendered by banks and other financial institutions on one hand and accessibility of banking facilities by the people on the other. The Financial systems, all over the world are charged with the responsibility of providing the means through which goods and services could be conveniently paid for by buyers. One of the services provided by banks is electronic banking which is inclusive of ATM that allows withdrawal of cash and transferring of fund from one account to another. Against this background, this study examines the introduction of cash-less policy by the CBN and the ATMs owned by banks with a view to evaluating the sustainability of the policy by the available ATMs using Akure South Local Government in Ondo State, Nigeria as a case study. The available ATMs in the local government were enumerated and data relating to the people of banking age were collected and it was discovered that the ATMs available in the local government were grossly inadequate and unevenly distributed.

Keywords: cashless society, ATM, Information and Communication Technology, Automation, Payment Infrastructure, e-payment

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Dr. P. S. Jagadeesh Kumar, Professor of Computer Science and Engineering, SR Engineering College, Hasanparthy, Warangal, Telangana.

Dr. S. Meenakshi Sundaram, Professor and Head of Computer Science and Engineering, DBIT, Kumbalagod, Bangalore, Karnataka

Conceptual - This document chiefly discusses the 3D game contraption and a variety of skill implicated in the advance of 3D games. It parleys the devise of 3D game engine and different genus of 3D games. The further spotlight is on the diverse skill and the outfit vital in beginning a 3D game. The computer game manufacturing has embarked on an abrading merchandise and expertise from its preliminary pursuit heredity to a numeral of "staid" engineering. Games are mortal espoused for protection, linctuses, structural design, edification, and regime appliances. All of these diligences are now supplied by a conventional folks of tropes that classically do not employ games or the expertise that support them. The quick augmentation in the authority of game technologies and the rising communal receipt of this knowledge has fashioned an atmosphere in which these are relocating other production explicitly computer hardware and software group. This paper lays brash a game bang that recognizes the precise services that induce manufacturers to espouse gaming skills for their mainstay commodities and provisions.

Keywords: 3D Game Contraption, Genus of 3D video game, 3D Game Augmentation

13. Paper 30091534: Type2 Fuzzy Soft Computing Technique For Image Enhancement (pp. 94-105)

U. Sesadri, Vaagdevi Institute of Technology and Science, Proddatur

C. Nagaraju, YSRCE of YVU, Proddatur

Abstract - The standard purpose of Image enhancement is to process an image so that outcome is more appropriate than original image for definite application. The fuzzy logic is one of the soft computing techniques to enhance the images by eliminating uncertainty. In this paper efficient type2 fuzzy logic technique is used to get better quality image. This method consists of two steps. In the First step fisher criterion function is useful to generate type1 fuzzy membership value. In the second step based on type1 membership value fuzzy rules are derived to enhance the image. The type2 fuzzy method is compared with type1 fuzzy. The table values and graphs prove that the proposed method gives better results compared with fuzzy type1 method.

Keywords: fisher criterion, fuzzy type1, fuzzy type2, membership function and soft computing.

14. Paper 31081505: Design of an Automated River Water Level Monitoring System by using Global System for Mobile Communications (pp. 106-111)

Agrey Kato, Electronics and Telecommunication Engineering, The Nelson African Institution of Science and Technology, Arusha, Tanzania

Ramadhan Sinde & Shubi Kaijage, Electronics and Telecommunication Engineering, The Nelson African Institution of Science and Technology, Arusha, Tanzania

Abstract – This paper proposes a wireless solution, based on Global System for Mobile Communication (GSM) network for the monitoring and controlling of the river water level parameter. One of the advantages of the system is that it can be used for monitoring decrement of water level in the rivers and water level rising in case of flooding. The system at a certain interval continuously sends river water level measurements to the concerned authority with water environmental flow management. But once the river water reaches the critical level either by decreasing or flooding, an alarm will be sent via GSM network to the personal in charge, furthermore, the proposed system allows on-line configurations of the system equipment's at the field. This system, uses open access platform Arduino as main controller, ultrasonic sensing equipment and web infrastructure that allows remote access of information from any place of the country.

Keywords: GSM, Open Access Platform Arduino and Ultrasonic Sensor.

15. Paper 31081506: Analysis of ICT Application in Mitigating Land Conflicts: Case Study of Tanzania (pp. 112-116)

Micky Thambikeni, School of Computational, Communication Science and Engineering (CoCSE), Nelson Mandela – African Institution of Science and Engineering (NM-AIST), Arusha, Tanzania

Anael Sam, School of Computational, Communication Science and Engineering (CoCSE), Nelson Mandela – African Institution of Science and Engineering (NM-AIST), Arusha, Tanzania

Abstract — Land conflicts are common phenomena in Tanzania. They can be understood in the context of history, social relations and the process of commoditization of natural resources such as land and land resources. One of the factors causing land conflicts is the poor land use planning and management. Tanzania has about 44.0 million hectares of arable land in Tanzania, but only 23% (about 10.5 million hectares) is being utilized. In this study literature review is done to understand the context of land information management, then take a look at how land use plan is being practiced at district level and how ICT is applied in land use plan towards land conflicts mitigation. The study aims to analyze ICT potential role by identifying factors causing land conflicts that can be solved by ICT and establishing ways of mitigating the conflicts. This can be accomplished by integrating ICT in land use planning and management for easier inventory and allocation of land resource. The study conclude that, implications of ICT for the land use management at district level have impact towards land conflicts mitigation, because ICT can enhance land administration through modern ways of keeping land information and can help policy and decision makers in reaching good decision making.

Keywords—Land Conflicts, Land use, Arable land, ICT, LIS, GIS, DBMS

16. Paper 31101530: Diplomatic Behavior of Big Data in Health Science (pp. 117-121)

G. Rasitha Banu & Murtaza Ali, Jazan University, Kingdom of Saudi Arabia.

Dr. N. Sasikala, Dept.of.Computer Science, Md. Sathak college

Abstract - Information are stored and used as data which is one of the most valuable resources for all purposes of further proceedings. High-quality information is used as sources for creation of knowledge and processing of various fields in science and technology. This information has great potential for impacting in human life and supports to the specific time by wider audiences and coalitions of stakeholders. Big data is a process of data collection, data organizing, and analyzing large sets of data to discover interesting patterns and other useful and meaningful information. Big data helps the organizations to provide better understand of the information contained within the data. It also helps to identify the data that is most important to the business and health science.

Keywords: Big data, Analytics, Healthcare, uniqueness, biomedicines.

Information System Audit;

A study for security and challenges in Nepal.

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Abstract—Life can be made better and easier with the growing information and communication technology. Efficient Software and Hardware together play a vital role giving relevant information which helps improving ways we do business, learn, communicate, entertain and work. This exposes to an environment with significant risks which are vulnerable to inside or outside attacks. System audit, thus, becomes important and is a key process to assure security, reliability and our dependency on such systems. The information system audit for security can increase the chances of adopting sufficient preventive and security measures for prevention or lowering of consequences. This paper is prepared upon exploration and studies on information system security and challenges in Nepal. Data is collected by online survey and the analysis of data helps to explore its current status of security and challenges for Information System Audit in Nepal.

Keywords— *Information System; IS Audit; System Audit; Security; Challenges; Risks;*

I. INTRODUCTION

Information and Communication Technology (ICT) has participated its' best in the development and growth of any industry or organization, however, it has also created significant and unprecedented risks. Information Security (IS) can be referred to any processes, activities, or set of tasks that safeguards the integrity, confidentiality, and accessibility of information [12].

Internet is global and in the internet, almost all are interconnected and able to reach data at different geographical locations. This has been boon to mankind to be able to live in an era where information in no matter of time can be obtained but at the same time it also opens up the risks of sabotage, fraud, malicious or mischievous acts which could lead to several problems such as privacy issue, financial loss etc. These risks have to be controlled and minimized. There are several ways of applying security techniques. The application of security techniques solely depends on the nature of risks. It becomes priority to identify the potential risks before techniques are selected to provide the security for the data or the system or organizations. Audit is inspection or assessment of the process or outcome against defined standards or guidelines. Information System Audit (IS-A) is the assessment of Information System against the standards or guidelines.

II. OBJECTIVES

The main objective of this research is to study Security and Challenges of Information System Audit and its importance. The researcher shall conclude its current status in Nepal.

III. LITERATURE REVIEW

Information System Audit helps in auditing risks and thus improves the organization security system by evaluating system processes of organization and controls against a baseline. Audits are planned and designed to give an independent evaluation and assessment. Audits may also provide a gap analysis or operating effectiveness of the internal controls [1].

A. Security Risks and Challenges

Risk is a potential of losing something which can be categorized in two groups, that is, physical risks and logical risks. Physical Risks are more closely related to physical equipments which could be damaged by natural disaster such as earthquakes, floods, fire, bombings, theft, vandalism etc. Champlain has distinguished a list of controls that can help in the protection of IS against above physical menaces or threats such as:

- different types of security locks,
- procedures to perform timely backups of the IS and data,
- insurance coverage for hardware crash or loss,
- costs to restore or recreate or regenerate data,
- offsite backup and storage,
- rotation of backup devices/ media to secured location,
- tested disaster and recovery management programs (Business Continuity Program -BCP) [3].

Logical Risks are such risks that do not occur physically but occur logically. They can be unauthorized access or breach to the system such as by accident or intention for IS and data destruction or alteration. Mitigation of such threats are done by logical security controls such as by writing policy for user access to the IS and preventing unauthorized access of system.

As per Symantec, Organizations should address following four main types of ICT risks and they are

- security risks, which includes several external logical threats such as virus, targeted attacks on applications or users or information etc.
- availability risks,
- performance risks, which includes failing to perform as designed and
- compliance risks of failing regulatory compliance regulatory that could expose to legal penalties, financial forfeiture [4].

The security risks are major with the unauthorized information access such as data privacy/ leakage, fraudulent and forgery, and end-point security.

Obstacles and Challenges in cyber security of Nepal are debilitating disruption of operation of the information system, spam mails, online frauds, sniffing of passwords etc [5].

B. Audit Standards

“International Organization for Standardization”, ISO has several standards and among all of them ISO 27000 is on information security [2][10]:

- ISO27001 is a standard published on October 2005 with an objective of providing “a model for establishing, implementing, operating, monitoring, reviewing, maintaining, and improving an Information Security Management System”.
- ISO27002 is a standard formerly known as ISO17799 is a code of exercising information security. This standard established guidelines and general principles for initiating, implementing, maintaining, and improving information security management within an organization.
- ISO27003 standard aims to provide help and guidance in implementing an Information Security Management System (ISMS).
- ISO27004 is a standard first published in December 2009 with an objective to provide guidance on the development and use of measures, standards and measurement for the evaluation and assessment of the effectiveness of an implemented information security management system and controls, as mentioned in ISO27001.
- ISO27005 provides instructions and standards for Information Security Risk Management (ISRM) for such organizations that support the requirements of an ISMS defined by ISO27001.
- ISO27006 is a standard that provides guidelines for the accreditation of organizations offering ISMS certification. Its formal title is "Information technology - Security techniques. Requirements for bodies providing audit and certification of information security management systems". It is a standard intended to be used in conjunction with a number of others standards and offers instructions and guidelines for the accreditation of organizations which offer certification and registration with respect to an Information Security Management System.

- ISO27007 is a standard for auditing ISMS against ISO 27001. It suggests principle of Auditing, Audit Activities and Competence and Evaluation of Auditors.
- ISO27008, approved in April 2008, is a standard for Information and Security Management Auditing with respect to security controls unlike ISO27007 which focuses on ISMS latter rather than specific controls. [10]

C. Audit Security Framework

Security audit's underlying structure or framework consists of several policies, well defined standards, streamlined procedures which can be used as mandatorily required components for any security system at an organizational level [7].

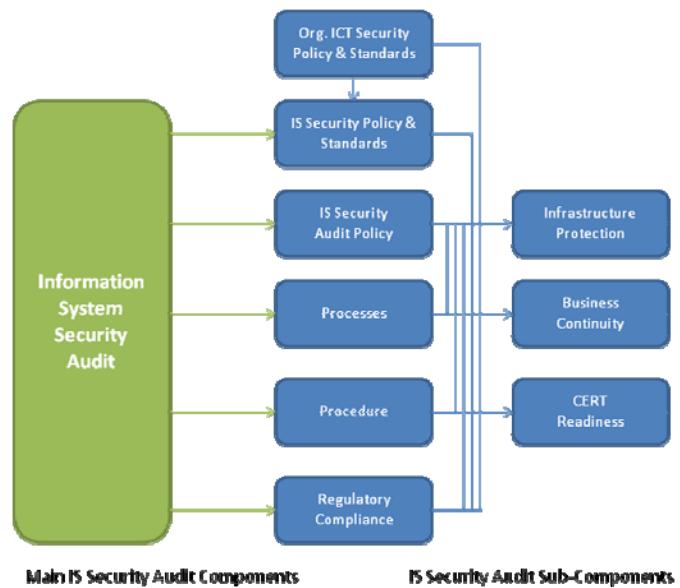


Fig. 1. Adopted: Security audit framework [7]

D. Audit Plan

A security audit has certain goals which must be achieved in right way. Some of such goals are:

- To check existing security policy, guidelines, standards, and procedures;
- To identify and examine effectiveness and laggings of existing policy, guidelines or standards.
- To examine existing standards, policy, procedures and guidelines.
- To identify and understand the possible existing risk and vulnerabilities.
- To review existing security controls on operational, administrative and managerial issues and ensure compliance to minimum security standards.
- To provide recommendations for existing system.
- To provide corrective actions that could be used for the improvements of IS and its effective implementations. [8]

IV. RESEARCH METHODOLOGY

Quantitative Research Methodology has been used in this research. The research theory of this paper has been to construct knowledge and meaning from Researchers experience, that is, Constructivism, which has direct application to education. The research theory indicates technological Constructivism. [13]

Primary data was collected by means of online survey where professionals from different areas of ICT were chosen, as shown in Fig. 2, which helped to study current situation in Nepal. Secondary data was collected from several comparative studies of different research papers/ journals which helped to gather information on international level.

V. RESULTS AND DISCUSSION

A survey was conducted to support this research and different charts are presented for further clarifications. There were 108 respondents to qualify in Fig. 2.

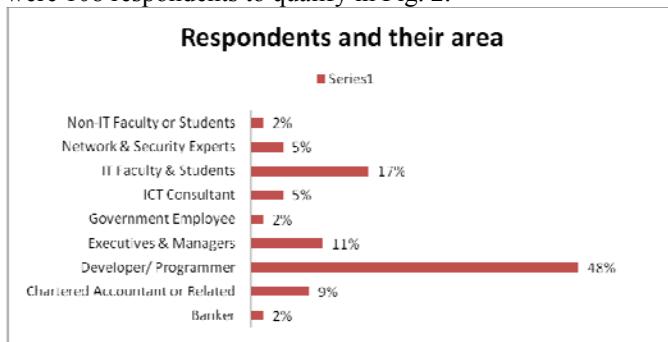


Fig. 2. Respondents and their area

Fig. 3. shows the result of survey done to check how many of sample audiences follow security guidelines for any information system development or implementation. The result showed that only 54.6% followed it, 36.1% only followed it in some cases and 9.3% did not follow it at all.

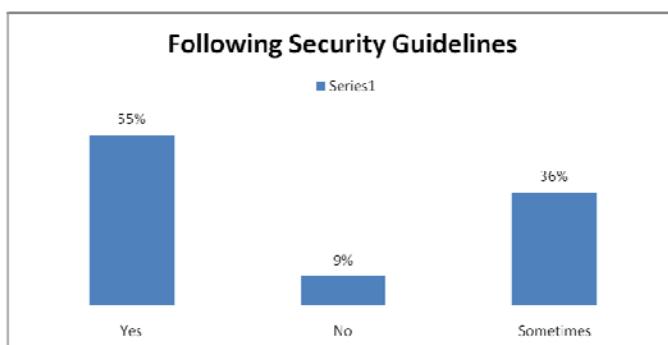


Fig. 3. Follow of Security Guidelines for IS development or implementation

Fig. 4. shows what leads users for Information System misuse. Majority of people were found to be misusing IS for personal gain without intention to hurt someone with 34%, 28% were found to be doing it as an intellectual challenge, 26% was found to be doing it out of curiosity and 9% and 4% of users were found to be doing it with a bad intention to

hurt someone and for personal benefit being aware of negative outcomes and consequences.

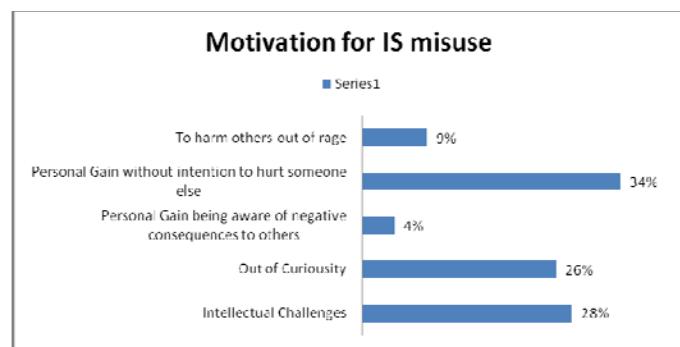


Fig. 4. Motivation for Information System misuse

Fig. 5. shows attacks from 2007 to 2014 has been growing relatively with prominent probability of attacks in any components of security audit mentioned in Fig. 1.

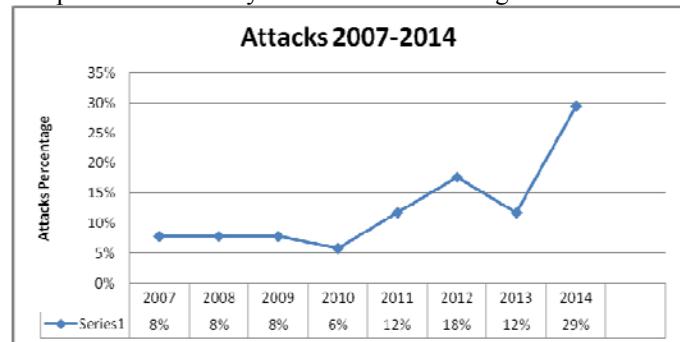


Fig. 5. Attack Analysis

Fig. 6. depicts experience on the different types of attacks or vulnerabilities experienced by user from 2007-2014 by ICT users from different fields as in Fig-1. The maximum attacks or vulnerabilities experienced by 87% are through computer viruses and then 42% of the troubles are because of website or system hack. User has least experience with DDOS as it is more of system level attack and usually is fixed once the system administrator knows about it.

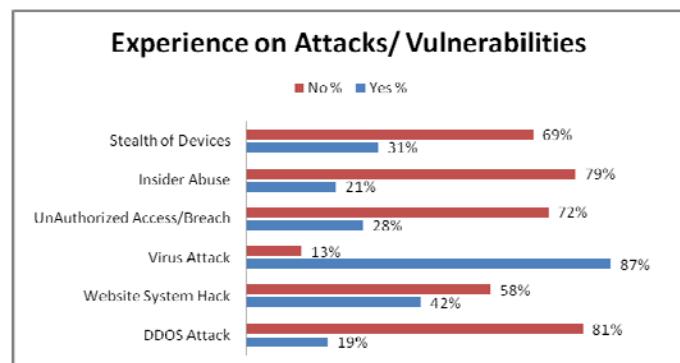


Fig. 6. Experience on type of Attacks

Fig. 7 depicts IS Audit Awareness in Nepal by 83.58% which looks promising as IS Audit practicing would not be very difficult job to begin [11].

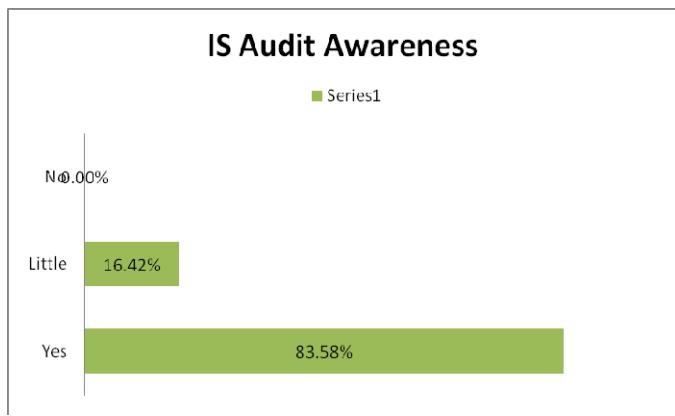


Fig. 7. IS Audit Awareness in Nepal [11]

VI. CONCLUSION

This research was conducted to explore security and challenges in Nepal in IS Audit. The study adds empirical knowledge of security and auditing and helps to figure out current situation of IS and its Audit in Nepal. It suggests ways to execute security auditing indicative for readiness.

The data interpretation helps to conclude that a special attention and care is required to keep the system free from viruses, as more problems in IS Security is seen because of Viruses. Furthermore, there are various types of security techniques or patches that must be applied based on the appearance or expectation of security threats or risks.

There are several Audit standards guided by ISO which can be followed for optimum safeguard of IS or resources.

Information System Audit programs are mandatorily recommended to make IS function effectively and efficiently.

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Enterprise resource planning II – A review of critical success factors

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Abstract— Delivering benefits from enterprise resource planning (ERP) II is challenging and the current research investigates the allocation of resources contributing towards benefits realisation. A literature review has been undertaken based on critical success factor (CSF) analysis. This research has revealed that ERP CSF change over time and that only some traditional ERP CSF are used in ERP II, as some are unnecessary whilst others are detrimental. In addition, ERP II specific CSF are also required to address extended enterprise opportunities. The use of ranked CSF is proving to be ineffective and ERP II CSF must be phased-in during the implementation process, as addressing CSF retrospectively is detrimental.

Keywords: Enterprise resource planning; ERP II implementation; critical success factors; CSF phasing; critical pathway steps; CRM

I. INTRODUCTION

In today's knowledge driven economy, enterprise resource planning (ERP) systems have become the foundation of extended enterprise opportunities [1-5]. Termed ERP II this provides organisations with an increased information sharing capability, enabling services to be made available through an enterprise portal through which different stakeholders can gain access to integrated services. A conceptual framework for ERP II highlights four collaborative components [6]; business to business, business to customer, business to employee and enterprise application integration, a platform for integration with other internal and external systems.

ERP II is a type of cyber-infrastructure and has been described as “an overarching concept that encompasses the hardware, software, services, personnel, and organisations that serve as an underlying foundation in support of collaborative network activities” [7, p105]. Indeed, a recent report has revealed that the main reason for adopting an ERP system is to achieve better integration of systems across multiple locations [8]. Extended enterprise initiatives have changed the competitive nature of some entire industry sectors; industries that invest more heavily in them are far more competitive in their nature [9]. In fact, using ERP II to improve customer satisfaction has been shown to have a direct effect on achieving greater financial gain [10].

Organisations can either implement an ERP II system outright, or upgrade their existing ERP system, which should

be treated the same way as an outright implementation [11]. The global ERP market grew by 3.8% in 2013 [12] and a report by Forrester Research has shown that the demand for ERP II is strong, with 25% of European and Asian organisations intending to invest further in their existing ERP systems [13]. In terms of the current demographic uptake of ERP systems, over 60% of smaller companies, 39% of large companies and 70% all of Fortune 1000 companies have already implemented ERP in some form [14].

Implementing or upgrading an ERP system is not an easy task and there have been many high profile accounts of bankruptcy for organisations attempting this [15-17]. Recently, just prior to filing for bankruptcy in 2008, the UK high street retailer Woolworths invested in a substantial ERP II implementation project up-grade. This group had been SAP's first UK customer in 1989 and upgraded to SAP SCM software in 2008; this was designed to serve its 820 stores by integrating a new merchandising system [18]. This failure is just one high profile account of a widespread problem facing organisations attempting to improve their collaborative network capabilities.

In excess of 90% of ERP implementations have been found to run past their scheduled go-live date [19] and furthermore, only about 35% of ERP implementations have been identified as being delivered on time and within budget [20]. For organisations looking to embrace extended enterprise initiatives, the “new or extra benefits that we expected have not materialised” [21, p106]. Over the past decade a great deal of research has been directed towards resolving issues facing ERP implementation failures by evaluating critical success factors (CSF). However, there are still uncertainties regarding CSF for ERP upgrades and outright ERP II implementations.

II. METHODS

The current research has undertaken a comprehensive review of ERP CSF to gain a greater understanding of ERP II implementation requirements. One study reveals 24 specific research areas within the discipline of ERP [22] and CSF have been ranked or prioritised within each of these different areas [23-29]. The top ranked ERP CSF are frequently used to provide direction for empirical research in ERP implementations [27, 30-34]. Fundamentally, CSF research is concerned with evaluating ‘winning’ companies [35], or, in the context of ERP implementation, achieving the goal of the

implementation effort [36]. Ensuring ‘critical’ tasks are undertaken guarantees that senior management give them the necessary attention and, as such, resources are more effectively allocated when delivering the overall implementation objective [37, 38]. Learning from successful implementations makes CSF analysis an invaluable tool [39] as it can be used to clearly diagnose problems and provide lessons learnt for future implementations [40].

The strongest criticism towards CSF research suggests that the identification of success factors relies heavily on the opinion of managers, and therefore introduces unduly positive feedback and the potential for a biased evaluation of the implementation [41]. In addition, if researchers solely look at pre-published success factors as a basis for undertaking empirical research, there is a danger of these becoming a self-fulfilling prophecy. To address the limitations of CSF analysis, key issues identified in the current research have been appraised in the context of the implementation lifecycle [3, 21, 42-45], which is comprised of four distinctive phases: chartering, project, shakedown, and onward and upward [46]. In addition, key issues have been evaluated in the context of resource based investments; resource investments made during an ERP implementation are allocated into the areas of people, process and technology [47], which are considered to be the fundamental pillars of any information system.

The misalignment of resources during an implementation has been termed technical isomorphism [48], empirical research has highlighted that even when the technical implementation itself has been a success, there can be difficulties in establishing the most effective processes for achieving the desired benefits [49]. Compounding this issue, is the widespread underinvestment in training which is having a significant impact on benefits being realised in an ERP II environment [50].

To accurately search for relevant journal publications, published league tables were used and in addition, journal databases were searched. A broad set of ‘key words’ were established [51] and these covered a wide spectrum of issues deemed to be relevant in the context of the current research, as outlined in table I.

TABLE I
LITERATURE SEARCH TERMS

Key Words
ERP
ERP II
Critical success factor
Critical success factor ‘AND’ CRM
Critical success factor ‘AND’ ERP
Critical success factor ‘AND’ Enterprise resource planning
Critical success factor ‘AND’ IT
Critical success factor ‘AND’ MIS
ERP ‘AND’ Customer relationship management
ERP ‘AND’ e-commerce
ERP ‘AND’ e-service quality
ERP ‘AND’ Extended enterprise
ERP ‘AND’ Implementation
ERP ‘AND’ Knowledge sharing
ERP ‘AND’ Supply chain management
ERP ‘AND’ Training

To ensure relevant journal publications were not overlooked in the formulation of this literature review, publications from key journals were also evaluated; the titles and abstracts of these publications were reviewed for relevance over a five-year period. In sourcing key journals, a list of leading industry-specific journals was identified through recommendations from industry experts. In addition, other leading journals within the field of information system research were identified using the Aston Business School published league table of journals [52].

In searching the body of literature covering ERP CSF, a process of open coding was adopted which pertains specifically to the naming and categorising of a phenomenon, involving the breaking apart of data, delineating concepts and ultimately qualifying concepts in terms of their properties [53]. To validate the choices made in categorising papers, content analysis was used [54]. This approach has been shown to be an effective methodology in this type of research setting [55] where the number of instances when an issue was cited within the literature was counted to determine its relevance. If the categories outlined are sufficiently precise [56], content analysis has been shown to ensure a high reliability of its measure, and as such adds validity to the decision of selecting these ‘critical’ issues. The use of CSF genres has also been shown to be an effective way of classifying ERP CSF [44].

III. RESULTS

A. The changing nature of ERP CSF

In the current research two of the most comprehensive ERP CSF ranked lists, undertaken in 2001 and 2007 [55, 57], have been compared and contrasted as outlined in table II. This evaluation has revealed that ERP CSF change over time and compliments our current understanding, where in the early 2000s ERP research focused on collaborative commerce, subsequently in the mid-decade research moved towards leveraging integration and then in the late decade research focused on seeking better utilisation of IT infrastructures [44].

The analysis undertaken has shown that redundant CSF disappear and are replaced by newly identified, more effective CSF, in a process based on resource investments contributing towards benefits realisation. Of the CSF which disappeared over the period, i.e. are not present in the evaluation carried out in 2007, several are related to supplier driven issues, and include: ‘vendor partnership’, ‘architecture choices’ and ‘minimal customisation’, whilst others include ‘dedicated resources’, ‘steering committee’, and ‘education on new business processes’. One explanation for this is that the client is becoming more involved in their own implementation decisions. This point is re-enforced by the fact that CSF that provide the supplier with decision making abilities are also disappearing, which include: ‘vendor’s tools’ and ‘use of consultants’. If the client organisations are becoming more involved in their own decision making during the implementation process, it would seem that they are more readily dictating the implementation agenda.

TABLE II
RANKING COMPARISON OF ERP CSF

ERP CSF Classification in 2001		ERP CSF Classification in 2007	
1	Top management support	(1)	Top management commitment and support
2	Project team competence	(19)	Change management
3	Interdepartmental cooperation	(16)	BPR and software configuration
4	Clear goals and objectives	(14)	Training and job redesign
5	Project management	(2)	Project team: the best and the brightest
6	Interdepartmental communication	(4)	Implementation strategy and timeframe
7	Management of expectations	(9)	Consultant selection and relationship
8	Project champion	(7)	Visioning and planning
9	Vendor support	(3)	Balanced team
10	Careful package selection	(8)	Project champion
11	Data analysis and conversion	(6)	Communication plan
12*	Dedicated resources	New	IT infrastructure
13*	Steering committee	New	Managing cultural change
14	User training	New	Post-implementation evaluation
15*	Education on new business processes	(10)	Selection of ERP
16	Business process re-engineering (BPR)	New	Team morale and motivation
17*	Minimal customisation	New	Vanilla ERP
18*	Architecture choices	(5)	Project management
19	Change management	New	Troubleshooting/crisis management
20*	Vendor partnership	New	Legacy system consideration
21*	Vendor's tools	(11)	Data conversion
22*	Use of consultants	New	System testing
23		New	Client consultation
24		New	Project cost planning and management
25		New	Build a business case
26		New	Empowered decision makers

KEY: '*' denotes disappearing CSF,
'NEW' denotes new CSF and ')' denotes previous ranking

Of the newly appearing CSF, i.e. not present in the evaluation carried out in 2001, it is clear that these are client driven CSF, and include: 'client consultation', 'build a business case', 'legacy system consideration', 'post-implementation evaluation', 'IT infrastructure', and 'system testing'. In addition, the CSF which deal directly with organisational change are also becoming more prominent, and include: 'managing cultural change', 'team moral and motivation', 'vanilla ERP', 'troubleshooting/crisis management', 'project cost planning and management', and 'empowered decision makers'.

B. A review of the highest ranked ERP CSF

Top management support is widely acknowledged as being the top ranked CSF for an ERP implementation and this has been widely cited in literature [20, 24, 29-31, 43, 57]. In regards to this, having a top down management philosophy has been identified as being critical [21]. The exact level of 'support' required from top management has also attracted a great deal of interest. The type of support offered by top management extends widely, although the awareness of the role they play is essential [58]. Broadly these activities include offering their political persuasion, influential skills, providing financial budget assurances and other resources as required [33, 59]. Research specifically suggests that having a high level business side sponsor is needed [60], which involves top management buying into the goals of the overall project and having dedicated commitment to it [27, 55]. It has also been found that strong and committed leadership at the top management level is required throughout the entire life-cycle of the ERP implementation [61].

Project team competence is a highly ranked CSF [31, 57] and an important aspect of this is the careful selection of acquisition team members [28]. Selection of the project team leader is particularly important and this person must be a veteran [24], and able to assert clear and unambiguous authority for the implementation to be a success [28]. The formulation of a great implementation team is necessary [27] and one key issue in achieving this is evaluating the level of education of the project team members, as selecting the best and the brightest candidates has been found to be a critical factor [55]. When selecting project team members, it is necessary to seconder members from affected departments to guarantee relevant experience is incorporated into the project team [29] and utilise members with former implementation experience [33]. Achieving a balanced team is required [55] since the tasks the project team members perform are wide and varied, and often relate specifically to the duty of the specialist appointed. Some critical aspects noted in literature reveal that it is important to ensure that project team members are capable of: undertaking mapping exercises, having technology fixing capabilities and undertaking cost management exercises [30, 60, 62]. It is also important that project team members are decision makers [24]. Ensuring project team competence revolves around ensuring the team is able to work together [43], and as such the moral and motivational skills of the project team members is a key factor [55]. However, this must be tackled during the early stages of the implementation [63].

Interdepartmental communication is a highly ranked CSF for ERP implementations [31, 57] and involves ‘business systems thinking’ [60]. In addition, the establishment of a communication plan has been identified as being essential [55], in conjunction with the use of a communications matrix [29]. Findings show that having open and honest communications during the implementation process is necessary [30] and bridging and bonding between internal staff groups is required for successful interdepartmental communications [63]. Preparing an inter-organisational plan is a critical task [64] and ensuring that there is an IT readiness to facilitate this change is required [55]. The MIS department has been found to play an important role in the implementation process [65], with effective portal governance being an important aspect of connecting departments [61]. Interdepartmental cooperation is important [31, 57] and includes dealing with multi-site issues in large implementations [27]. A partnership approach has been advocated [28], whereby a relationship building exercise is required in establishing an understanding between departments [60]. An essential task is to engage with the heads of departments directly [30], as this leads to the adequate support required from functional units [16], particularly in their contribution towards system testing [55].

Having clear goals and objectives is a well-founded CSF [27, 31, 57] and it is important that these are aligned with current processes or linked with the intended overall business strategy [30, 33, 62]. In addition, incorporating the ERP implementation into a wider shared and clear vision is necessary in achieving a successful implementation [22, 55, 59], as is the concept of linking with a wider change programme [66] and recognising the need for change [59]. For achieving clear goals and objectives it is important that there is clarity at the chartering phase [46] and this must involve senior management [21] and to have a realistic estimate of value-adding processes [67]. Here, it has been found that essential architecture choices must be made [57] where IT leadership has been found to be critical [60]. Deciding on the initial approach is necessary, be that a comprehensive ‘big bang’ approach, a middle-of-the-road option or one that is more incremental in nature, such as the ‘vanilla approach’ [68]. Whichever approach is decided upon, it is essential that this approach should focus on performance measures [27], and that these measures are aligned by all stakeholders [30]. However, in order to achieve a sound management of expectations, performance indicators must be aligned with the overall implementation objectives [69].

Project management is a highly ranked ERP CSF and this has been widely cited in literature [27, 31, 43, 55, 57, 65]. Critical steps for the project team are: establishment of an implementation strategy [55], architecture planning [60], undertaking regular workshops [30] and setting key milestones [29]. In setting key milestones it has been shown that the use of a time box philosophy is needed [60], which supports findings regarding the criticality of time management [70]. In addition, other specific critical tasks have been identified as being: planning, budgeting, scheduling and management [55, 70, 71], which involve having empowered decision makers [55]. It is important to establish a road map of tasks [59] and the undertaking of these must be guided by the establishment of a

steering committee [57, 72]. Gaining senior management support is necessary in tackling the issue of resistance to change [29], as senior management establish coalitions of interest groups [21] for performing troubleshooting and crisis management exercises [55].

Change management has been well cited in literature as being one of the highest ranking CSF for ERP implementations [24, 27, 43, 55, 57], which is not surprising as most organisations need to restructure their operational procedures in order to accommodate this type of system [66]. Important aspects of this include developing a culture of accepting change [46], managing cultural change [55] and instilling a readiness for change [73]. These are all aspects which lead to the achievement of an appropriate implementation climate, which is important [74]. The managers at an operational level will not support a new system if their information needs are not addressed and this often requires business process re-engineering to be undertaken. Tackling the resistance of users [16] is also an essential part of dealing with change and achieving user buy-in has been found to be needed in tackling this [28]. One approach in resolving this is the use of super users [72]; however, this can also be dealt with organisationally by the utilisation of the HR function [16, 32, 63]. HR also deal with any compensation packages which may need modifying due to the implementation [75]. The HR department can be used to instill a common sense of urgency [59] until a ‘satisfying’ mindset prevails [24], which have both been found to be important factors. In tackling the important aspect of resistance to change, achieving a harmonious implementation [65] and delivering a philosophy of transparency and social integration during the implementation process [76] are necessary.

Undertaking business process re-engineering and software configuration improvements has been identified as being a highly ranked ERP CSF [16, 57, 58, 72], and research shows that this must involve the establishment of a planned, structured and rigorous process [28]. To achieve this, business process re-engineering and software configuration is essential [55], which involves the key aspect of understanding the existing legacy systems [55]. It is important for process adaptations to be made [65] and to achieve this it has been found that introducing an ‘as is’ ‘to be’ evaluation is most effective [28, 77]. Business process re-engineering is required when undertaking an ERP implementation and it has been suggested that this should begin by undertaking a cost-benefits analysis [1], as only by understanding the pros and cons can a clear picture be revealed regarding the processes that need re-engineering. It is also necessary at this point to identify and build on key in-house IT capabilities [60], which may require changing current business processes. Here it has been found that a critical task is ensuring the project team utilises the knowledge of system users when defining the new functionality [21]. Job mapping in the process mapping phase is necessary [78] in order to address the technical specifications and customisations required [65]. A case study was undertaken to demonstrate that an ERP system can successfully replace old legacy databases [79], noting specifically that overcoming dirty data migration problems and identifying key customer data sets are essential aspects. Acquiring accurate and reliable information has also been

found to be important [27, 28] as is the process of identifying any data misfits [80], which are both used for achieving data conversion [55, 57]. Establishing a knowledge formulation phase has been identified as being necessary [81] and involving internal staff throughout this knowledge formulation phase is important [65]. One critical application of this phase is utilising end users to advise on job linking activities [82]. Indeed, a testing strategy is needed as it can reveal ‘show stoppers’ in terms of their essential data requirements [11]. User involvement in change management situations has been found to be important [74] particularly in informing users of any job redesign issues concerning the nature of their work. Knowledge management during the implementation process is important and initially an evaluation and integration of legacy systems must be undertaken [65]. An important consequence of using end users in the knowledge formulation phase is that internal staffs’ professional management knowledge of the system will be heightened post-implementation [34]. Ultimately, knowledge management relies upon the organisation’s flexibility for further learning [60] and the user’s maturity for the application of new technology [65], which have both been cited as being critical.

Training and job redesign has been identified as being a highly ranked ERP CSF. It is important to undertake an extensive amount of employee education and training [27, 65]. During the implementation it is essential to train the end user about the concept of ERP for the full benefits of the system to be realised [34] and to educate users on new business processes [57]. Business process re-engineering is completed post-deployment by the task of real-world testing and evaluation [55, 59], especially where the system is open for the use of the general public, where anxiety may preside [59]. Senior management must decide on a number of issues regarding the training delivery, one finding is that training should be outsourced [29]. Establishing training intervention is necessary [72, 83] and it has been found that delivering hands-on training works best [81]. Indeed, ensuring all users receive training is necessary [57]. The client organisation must make provision of dedicated resources to the training programme [57], and user participation is needed in the training process [28]. Making decisions on possible ways for restructuring personnel post-implementation is important [84] as is utilising training to inform users of any job redesign issues concerning the nature of work which enables them to fulfill their job description [55]. One important way to evaluate the progress of the training has been found to be undertaking performance evaluations [65].

Vendor support has been identified as being a highly ranked ERP CSF. Incorporating expert opinion is important, be that through the vendor itself or through other external partners who can also add value. Supplier development, for example, has been found to be an important aspect [11, 55]. This can be achieved by incorporating a support element into the contract and is particularly important for facilitation and monitoring purposes which have both been found to be critical [60]. Having positive relations with external partners is naturally important; however, it is important that the relationship with the vendor is a good one [57], even to the extent that this relationship must be harmonious [62]. Aligning the needs of the organisation and the software requires particular attention,

only here can mismatches be appraised. Fully understanding the similarities that exist between the organisation and the ERP package is a key aspect of vendor support [48]. It is important to perform a cost and benefits analysis prior to any outsourcing, for example the use of an application service provider [85]. Here the support of the vendor is extremely important, as only they have the tools to achieve this [57]. An important aspect of vendor support is that they must allocate more time explaining embedded data requirements to the client [80], and their expertise must be used for signing off process maps [30]. Achieving knowledge transfer is imperative [24, 86] and this relates to having an exemplary level of vendor support and upgrading the level of training support provided [11].

Careful package selection has been identified as being a highly ranked ERP CSF [31, 57]. Vendors sell particular packages or ‘brands’ of ERP, and the package selection has been found to be an essential factor. In fact, choosing the correct brand is important as minimal customisation has been found to be a necessity [55, 57, 87]. Selecting the right vendor is important, since if the strategic needs of the organisation are not positively exploited, the benefits realisation will be overlooked [88], and as such the client organisation must consider their system specifications beforehand [65]. Informed buying (of vendor package) by the client is key [60] and this can be achieved by utilising a team-based selection, which has been found to be an effective approach [67]. The utilisation of stakeholder/sub group evaluations in the adoption process is necessary [89] since this approach maximises the business alignment choice [30]. Ultimately, a competent client side negotiating team is needed [90], and it has been found that the establishment of selection and evaluation criteria is an important aspect of the vendor selection process [28]. Indeed one essential selection criterion has been found to be the amount of expertise the vendor has in their particular field, be that the industry sector or strategic application of the ERP system [91]. However, a client appraise of customer needs should be undertaken pre vendor selection [92].

C. What are the implications for ERP II CSF?

The collaborative capability provided by ERP II requires customer-facing processes to be incorporated into the system design, and having a clear understanding of the principles of customer relationship management (CRM) prior to any ERP II implementation is essential; the integration between ERP and CRM systems has been termed E-CRM [93]. Little research exists to bridge the gap between ERP and CRM implementation requirements and yet this has a significant impact on ERP II implementations, which encompass elements of both during its implementation. A comparison between the top five highest ranked ERP and CRM CSF reveals that there is a significant difference in the way that traditional ERP and CRM implementations are managed [57, 94], indeed of the highest ranked CSF for both, only one matched, and this was ‘top management support’, as outlined below:

ERP implementations are managed as projects; usually a project team is allocated and a clear implementation framework is established. Indeed, one of the primary measures of success attributed to ERP projects is completion on time and within budget [19, 20, 71]. The top ranked ERP CSF identified re-

enforce this point, as both 'project management' and 'project team competence' are identified as being among the highest ranked CSF for this type of implementation. In addition, 'interdepartmental cooperation' and 'clear goals and objectives' are also listed in the highest ranked CSF, which are both essential elements of project based tasks.

CRM implementations adopt a different approach to ERP implementations, one where cultural change is the highest issue on the implementation agenda. This is a philosophy where 'communication of CRM strategy' is the most important issue, which is a highly ranking CRM CSF, possibly due to the complex nature of the customer-facing processes involved. Cultural change is achieved by having 'knowledge management capabilities', which is also a highly ranked CRM CSF as end-user feedback is obtained prior to the system being designed. In facilitating the new system, these organisations adopt a 'willingness to share data', which inherently leads to a 'willingness to change processes', which are both highly ranked CRM CSF, as collectively the people involved recognise that they do not operate alone, but as part of a wider network with a common goal.

ERP II implementations require an entirely new philosophical approach compared with its predecessor as it incorporates elements of both ERP and CRM in its design. Whilst the implementation of ERP II relies heavily upon many of the same principles of traditional ERP systems, not all of these resource-based investments contribute towards benefits realisation in a customer-facing environment, indeed some ERP resource investments have been found to be counterproductive [95] and furthermore, additional ERP II specific resource-based investments are required in order to improve collaborative capabilities.

IV. CONCLUSIONS

This research presents a holistic overview of the CSF required to achieve a successful ERP II implementation. There is strong evidence to suggest that the traditional ways of undertaking ERP implementations are evolving, which is reflected in the newly identified and disappearing CSF. It appears that the ERP market is rapidly changing, with supplier organisations modifying their software solutions to meet the requirements of the current market demands, which are driven by their clients' needs to have a better utilisation of their IT infrastructures. The collaborative capability provided by ERP II requires customer-facing processes to be incorporated into the system design, as such having a clear understanding of the principles of CRM prior to an ERP II implementation is essential.

This literature review has revealed that there are currently 27 ERP II CSF that contribute towards benefits realisation, as outlined in table III. Of these 17 traditional ERP CSF are recommended for usage in ERP II implementations [42, 95]. Building upon the ERP CSF brought forward, this research has also revealed that there are 10 newly identified ERP II specific CSF [42, 95], which play crucial roles in achieving benefits realisation from the new customer-facing capabilities.

TABLE III
TAXONOMY OF ERP II CSF

ERP II CSF	Lifecycle phase	Resource base
Balanced team	Shakedown ^b	Process ^b
Business process re-engineering	Project ^a , Chartering ^b	Process ^b
Change management programme	Shakedown ^a , Onward and Upward ^b	People ^b
Clear vision	Chartering ^a , Project ^b	Process ^b
Communication plan	Shakedown ^b	Process ^b
Data accuracy/integrity	Shakedown ^a	
Implementation strategy and timeframe	Project ^b	People ^b
Management, Ownership and drive	Chartering ^a	
Managing cultural change	Onward and Upward ^b	People ^b
Organisational resources	Chartering ^a	
Performance monitoring and evaluation	Onward and Upward ^a , Shakedown ^b	People ^b
Proactive culture	Shakedown ^a , Chartering ^b	People ^b
Project champion	Onward and Upward ^b	People ^b
Project management	Chartering ^a	
Robust planning	Chartering ^a	
Training	Shakedown ^{a, b}	People ^b
Training strategy	Chartering ^b	People ^b
Collaborative partner support*	Chartering ^{a, b}	Technology ^b
Common partner goals*	Chartering ^{a, b}	Process ^b
Data standard consistency*	Shakedown ^a , Onward and Upward ^b	Technology ^b
Efficient legacy enterprise system*	Chartering ^a , Project ^b	Technology ^b
Extended enterprise understanding*	Chartering ^{a, b}	Technology ^b
Operational efficiency*	Chartering ^a	
Partner culture similarity*	Chartering ^a , Project ^b	Technology ^b
Partner trust*	Chartering ^a	
Relationship change management*	Shakedown ^a , Onward and Upward ^b	People ^b
Similar partner priorities*	Chartering ^a	

Key: Source ^a [42], source ^b [95] and '*' ERP II specific CSF

Research has shown that "Participants of the implementation projects do not appreciate the significance of particular factors which have an important influence on project success" [33, p430]. These findings emphasise the importance of having a clearly defined taxonomy of ERP II CSF. This concept was first outlined over two decades ago [96], which successfully led to a culture of prioritising and ranking ERP CSF.

A. The phasing of CSF in an ERP II implementation

Many authors agree that setting a clear strategic pathway is key in defining new processes [97-99]. However, problems can arise at any stage of an ERP II implementation lifecycle [46] and there are shortcomings if factors are not realised or corrected in a timely or logical manner [5], as such the need for critical pathway steps has been outlined [100]. Often resource-investments cannot easily be addressed retrospectively in this type of implementation. Only by allocating CSF at specific implementation lifecycle phases and against resource-investment areas can we hope to provide a clear taxonomy of the CSF required for ERP II implementations.

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Simulation Approach for a Comparison of Linked Cluster Algorithm and Clusterhead Size Algorithm in Ad Hoc Networks

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Abstract— A Mobile ad-hoc network (MANET) is a collection of wireless mobile hosts that dynamically form a temporary network without the aid of a system administrator. It has neither fixed infrastructure nor wireless ad hoc sessions. It inherently reaches several nodes with a single transmission, and each node functions as both a host and a router. The network maybe represented as a set of clusters each managed by clusterhead. The cluster size is not fixed and depends on the movement of nodes . We proposed a clusterhead size algorithm (CHSize). This clustering algorithm can be used by several routing algorithms for ad hoc networks. An elected clusterhead is assigned for communication with all other clusters. Analysis and simulation of the algorithm has been implemented using GloMoSim networks simulator, MATLAB and MAPL11 proved that the proposed algorithm achieves the goals.

Keywords- simulation, MANET, Ad-hoc, Cluster head size, Linked cluster algorithm, loss and dropped packets.

I. INTRODUCTION

1.1 Mobile Ad Hoc Network

Wireless networks have become increasingly popular in the computing industry. Currently there are two variations of mobile wireless networks: infrastructure and infrastructureless. The infrastructureless network is known as Mobile Ad Network (MANET). MANETs is one that comes together as needed, not necessarily with any support from the existing Internet infrastructure or any other kind of fixed stations. In a MANET, no infrastructure exists and the network topology may dynamically change in an unpredictable manner since nodes are free to move. As for the mode of operation, ad hoc networks are basically peer-to-peer multi-hop mobile wireless networks where information packets are transmitted in a store-and-forward manner from a source to an arbitrary destination, via intermediate nodes. As the node moves, the resulting change in network topology must be made known to the other nodes so that outdated topology information can be updated or removed[1]. Clustering has been proven to support ad-hoc networks whose topology changes dynamically. It is achieved by partitioning the nodes into groups called clusters. Each cluster is managed by a node called the clusterhead (CH) that is chosen among the nodes in the network, the cluster size is determined according to the transmission range of the clusterhead where all nodes within that range belongs to this

clusterhead. Each CH manages the packets' routes in and out of the cluster, which could cause a bottleneck at the CH, due to the updating of routing Tables in each node that might reduce the bandwidth of the link [2]. Many algorithms may be used to select the CH node [3]. The cluster may be chosen according to the lowest ID algorithm, or the highest-connectivity (degree) algorithm[4]. Chlamtac (1999) proposed another selection process based on the Least Cluster Change clustering algorithm or based on the node weight [5].

By reducing the exchange of control and management messages clustering improves the system capacity, eases location management, reduces routing Table size and leads to channel economy [6, 7, 8]. The role of the clusterhead is a temporary role and changes dynamically as the topology or some affected other factors changes. Any clusterhead should be able to change its role to that of an ordinary node to maintain the stable clustering structure. As such, the lifetime of the cluster is strongly related to CHs failure. The CHs are responsible to handle the traffic in their clusters. They have to transmit, receive and process the packets which consume power depending on the number of effective nodes in the cluster[9]. Therefore, to maximize the network lifetime, it is convenient to find a network design that optimizes the CHs energy consumption.

The energy resources are more limited in ad hoc wireless networks than traditional wireless networks [9, 10]. This limitation leads to each node functions properly is limited, which of course affects the functional lifetime of the entire network. Besides increasing network throughput and reducing the interference that mobile station experiences from different station, achieving lower energy consumption is the major issue in wireless ad hoc networks. Therefore, the study of energy efficient mechanisms is very important[11]. Our goal is to minimize the power control and energy cost of communication between any given pair of neighboring nodes, if such communication is possible.

II LITERATURE REVIEW ON ENERGY CONSUMPTION PROTOCOL FOR MANET

The limited availability of energy is a main challenge in wireless networks since charging or replacing batteries is inconvenient or even impossible. That means the lifetime of ad-

hoc network is limited and it is an important performance measure. Many researchers focusing on protocols that reduce power consumption. Some researchers assumed lower power may achieved by using intermediate nodes rather than using direct high transmission range[12].

Singh and Raghavendra (1998) proposed a Power Aware Multi-Access protocol with signaling (PAMAS) where a node consumes power both in sending or receiving packets. PAMAS reduces the power needed by 40-70 %. [13] Singh et al(1998) proposed another approach called Power Aware Routing Protocol (PARP) based on a proactive shortest path algorithm with a new routing metric [14].

Another approach based on minimizing the power consumption in each node by the random selection of nodes and its master node. Producing a protocol to achieve minimum energy is accomplished by maximizing the battery life through. It depends on the position of nodes that are randomly distributed. Each node sends a message holding its position to a master node, the master node knows all node positions and updates the network link to build minimum power topology [15].

Jung and Vaidya (2002) developed a power control protocol to reduce the collision which occurs in the DPC protocol based the relation between the power consumption and packets sending--receiving throughput[16] while Chiasserini et al (2004) developed a routing protocol that extends the network lifetime through Battery Energy Efficient (BEE) approach based on selecting a low energy cost route)[17]. Another approach proposed by Kawadia and Kumar (2003) known by COMPOW protocol, in order to achieve minimum energy consumption and to keep the network connected [18]. Ettus(1998) introduced a routing method that minimizes the consumed energy, called Minimum Consumed Energy routing (MCE) [18]. Finally Agarwal et al (2001) designed the Distributed Power Control (DPC). Each node selects different power levels for different neighbor nodes. They perform a new modification of IEEE802.11 MAC. The goal was to determine the minimum power needed for a node to transmit to another neighboring node successfully.[19]

Many researchers have been focused on the energy consumption and power control protocols of clustered networks. Elbat et al, (2000) purposed an approach to reduce the average power consumption and increase end-to-end throughput. The approach is based on clustering and finding the shortest path within each cluster[20]. Chiasserini et al, (2004) proposed two network topologies to maximize the CH and network lifetime by making the clustered MANET change slow and static. The proposed technique improved the network lifetime up to 15% [21]. Cano and Manzoni(2002) proposed an Intra clustered data-dissemination protocol (Icdp) to provide reliable broadcasting in clustered MANET. The CH role is distributed among the nodes periodically in order to decrease the overload at any single node. This approach supposed to saves 30% of NIC's energy. [17] Kawadia and Kumar (2003) proposed the COMPOW protocol to apply on clustered ad-hoc networks. Their protocols were CLUSTERPOW, TUNNELED CLUSTERDPOW and MAIPOW protocols. No CH is performed, and the clusters are formed based on transmission

power level. This protocol runs multiple independent proactive routing protocols, in order to find the lowest power transmission level used in inter cluster communication. While the TUNNELED CLUSTERD POW uses the encapsulation to optimize and resolve the infinite routing loop of the network, the encapsulation is for the IP address of a final destination of a message sent to the intermediate node. The MAINPOW is a distance vector routing protocol that uses the power control as a link cost. All the protocols implemented at the network layer. [22]

Many researchers focused on CHs transmission power adjustment which allow different power level for a node and create symmetric link problem where node A for example can reach node B while node B may not reach node A. In real life it is difficult to maintain such nodes that can adjust its transmission range by increasing the battery power or install new wireless card. Many algorithms are based on the position of nodes which may need more power consumption. The algorithms are based on lowest identifier are weak because such nodes may be located at any position in the cluster.

We propose a new mechanism that is simple and fast in formation called ClusterHead Size (CHSize) which take into account the node density, and the remaining power in the battery without the need to determine the node position which is consumes more power. Moreover, we will study the traffic load on the clusterhead, since CHs responsibility is to distribute services to other mobile hosts which cause some delay and/or loss.

III SIMULATION RESULTS AND ANALYSIS

We will present the analysis of the simulation results to compare the performance of clustered Mobile Ad Hoc Networks by LCA (Linked-Cluster Algorithm) and with CHSize (ClusterHead). The simulation experiments have been performed to determine the average energy consumption and the average throughput with respect to different performance measures.

3.1 Performance Metrics

Many parameters are used to evaluate the performance distribution services in MANETs. In this paper we will use the following five performance measures: service discovery ratio, throughput, dropped packets, energy consumption and packets delay.

The Service Discovery Ratio (SDR) or packet delivery ratio is defined as the ratio of the number of packets received by the destination to the number of packets originated by the application layer of the source (i.e. CBR source). The SDR specifies the packet loss rate, which limits the maximum throughput of the network. The better delivery ratio, the more complete and correct is the routing protocol.

Throughput is defined as the instant ratio of packet send/received, i.e. the instant efficiency of the network. Dropped Packets are the total number of packets that dropped due to the busy of cluster head, and it is computed as a count of the retransmitted packets due to the CTS timeout and the retransmitted packets due to ACK (Acknowledgment) time out.

Energy consumption or power consumption rate is measured by mile watt which is the value set based on the battery transmitter power coefficient, transmitter power in mile watt, battery transmitter power offset, and the battery sleep power. Also, the power consumption for transmitting signals is calculated as

$$(\text{BATTERY_TX_POWER_COEFFICIENT} \cdot \text{txPower_mW} + \text{BATTERY_TX_POWER_OFFSET}).$$

Where GloMoSim assumed that:

$$\text{BATTERY_SLEEP_POWER} = 50.0/\text{SECOND}$$

$$\text{BATTERY_RX_POWER} = 900.0/\text{SECOND}$$

$$\text{BATTERY_TX_POWER_OFFSET} = \text{BATTERY_RX_POWER}$$

$$\text{BATTERY_TX_POWER_COEFFICIENT} = 16.0/\text{SECOND}$$

Finally the delay which is the difference between the sending the request and received the reply on that request or a time taken for a client sending a request until receives the reply. Of course, the delay will be increase, as well as the dropped packets and overhead services increased. Congestion, collision, and queuing delay can be added to the amount of delay.

3.2 Simulation Results and analysis

Packet Size (byte)	Throughput (bps)		CHSize over LCA Improvement %
	with LCA	with CHSize	
64	119009.3	127375.9	6
128	120493.4	129688.3	7
192	123765.5	132785.1	6.5
256	127175.0	137620.4	7
320	131605.1	141992.1	7
512	141807.4	151770.9	6.5

Table 1: Throughput with CHSize and with the LCA algorithms

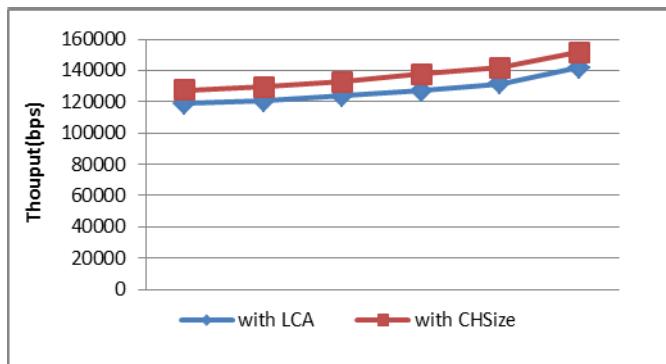


Figure 1: Throughput with CHSize and with LCA

In Fig. 3 and Table 2, we compare the average number of packets dropped by both algorithms(LCA and CHSize) for multihops transmission. The comparisons reveal that our proposed algorithm delivers more packets which is due to the proper use of the network. It also means the service achievements using clusterhead size algorithm in general is higher. We should notice that at some values of packet size , e.g. 320 byte the drop using the clusterhead size algorithm is larger than using LCA, of course it is a result of cluster head mobility which may increase the delay to a limit causes it to be dropped.

Packet Size (byte)	Average Dropped packets		CHSize improvement%
	with LCA	with CHSize	
64	17.8	16.6	6.7
128	17.8	15.8	11.2
192	17.2	16.2	5.8
256	19.6	19	3.0
320	20	20.8	-4.0
448	21.6	19.6	9.2
512	22.4	20.2	9.8

Table 2: No of Dropped Packets with CHSize and with LCA for Multihops transmission

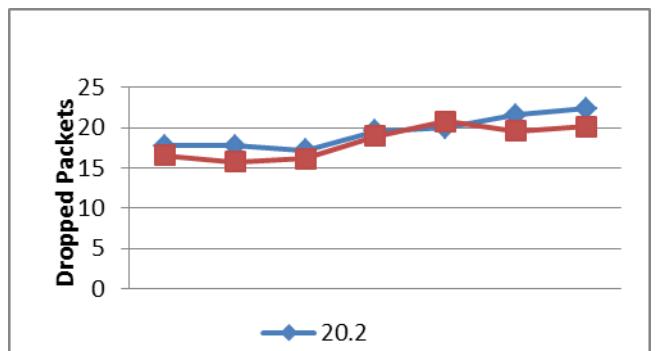


Figure 2: No of Dropped Packets with CHSize and with LCA for multihops transmission

Figure 3 and Table 3 show a comparison of single hop average dropped packets as a function of packet size. Here the packet drops has been increased with the increase of mobility nodes. It applies to the single hop transmission as a result of the increase time of network convergence. We notice also as the packets size increase the number of dropped packets increases while packets trying to reach the destination node. From Table 3, we may notice that the proposed algorithm is better than LCA, since the cluster form depends on the neighboring density, which give all node(s) a good knowledge about the adjacent networks. In LCA the node with the lowest ID is the clusterhead, so the position of this clusterhead helps in knowing the adjacent clusters.

When we compare the average dropped packets for single hops transmission and for multi hops transmission we find that the number of dropped packets in multihops is less than the number of dropped packets in singlehop, because the routes between nodes in multihops should pass through the clusterhead and as a result all the services is already available in the clusterhead.

Packet size (byte)	Average Dropped packets		CHSize improvement %
	with LCA	with CHSize	
64	61.37	58.69	4.3
128	62.26	58.82	5.5
192	62.49	59.21	5.2
256	62.52	59.47	4.8
320	62.77	59.86	4.6
512	63.11	59.93	5.0

Table 3: No of Dropped Packets with CHSize and with LCA for singlehop transmission Packet

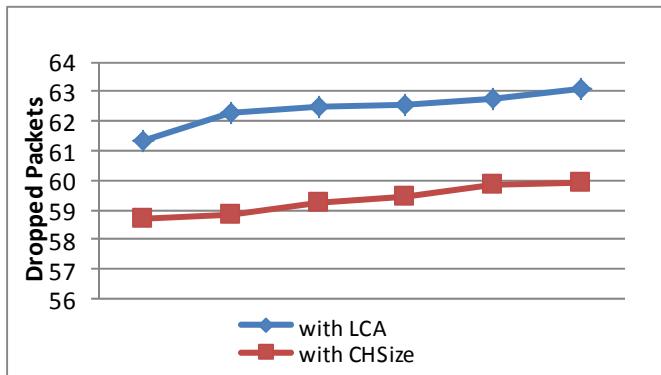


Figure 3: No of Dropped Packets with CHSize and with LCA for singlehops transmission

Total energy consumption as a function of packets size is shown in Figure 4 and Table 4 for both algorithms; the results show that both algorithms almost consume the same energy. Although the LCA consumes relatively less energy due to smaller size hello packets (i.e. Node ID only), while our algorithm uses larger hello packets that includes also beside the ID, the neighbor density, and the node energy consumption. This variance of the consumed energy levels can be neglected compared to achievements in total throughput, delay, and packet drops.

Packet size (byte)	Average Energy Consumption (mWhr)	
	with LCA	with CHSize
64	22.56	22.56
128	22.56	22.56
192	22.56	22.56
256	22.56	22.56
320	22.56	22.56
512	22.56	22.56

Table 4: Energy consumption (mWhr) with CHSize and with LCA for multihops transmission

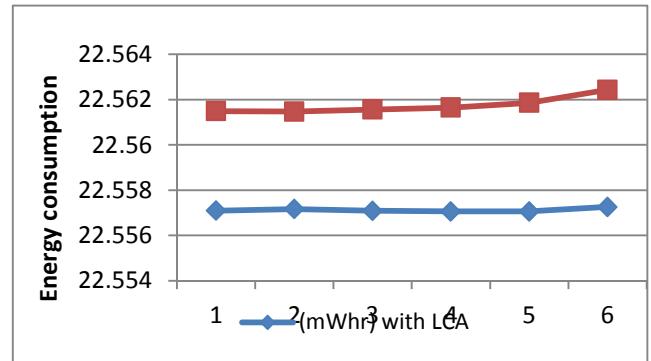


Figure 4: Energy consumption (mWhr) with CHSize and with LCA for Multihops Transmission

The service delay curves Figure 5 and Table 5 shows that the delay of LCA algorithm is a little bit higher due to the mechanism of cluster head selection (lowest id). Which can be anywhere inside the network. On the other hand our algorithm selection mechanism(highest density, energy consumption) will select clusterheads in the middle, this will helps when delivering services quickly, especially when services exists on other clusters, which for sure will decrease the overall delay.

Packet size (byte)	Average Delay		CHSize improvement %
	with LCA	with CHSize	
64	0.76	0.67	11
128	0.65	0.53	17
192	0.47	0.50	-5
256	0.69	0.53	23
320	0.57	0.67	-16
448	0.54	0.40	25
512	0.55	0.49	10

Table 5: Delay with the LCA and with CHSize for multihops transmission

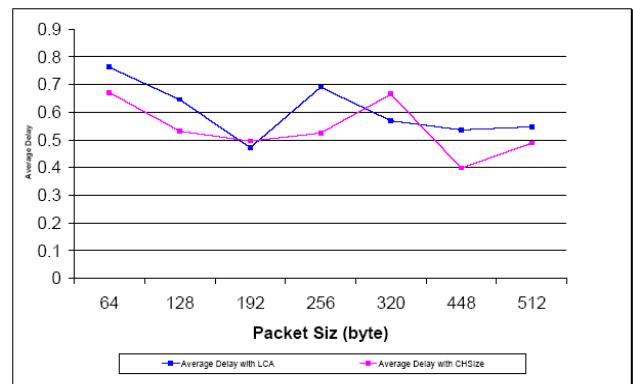


Figure 5: Delay with CHSize and with LCA for Multihops Transmission

In Figure 7 a plot for delay services curves while using mobility and without mobility, as we can see that the delay increases with the use of mobility which is normal as service providers will change their locations, which in turn increases the delay. The delay is varying according the way the nodes moved to or out the other nodes or it is clusterhead.

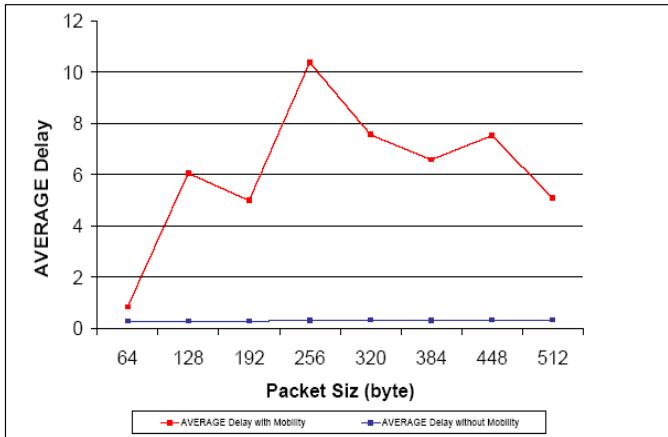


Figure 6: Delay with Mobility and without Mobility

Packet Size	AVERAGE Delay	
	with Mobility	without Mobility
64	0.843	0.293
128	6.067	0.294
192	4.994	0.293
256	10.383	0.325
320	7.564	0.344
384	6.589	0.315
448	7.532	0.342
512	5.079	0.343

Table 6: Average delay with mobility and without mobility

In Figure 7 a plot for delay services curves while using mobility and without mobility, as we can see that the delay increases with the use of mobility which is normal as service providers will change their locations, which in turn increases the delay. The delay is varying according the way the nodes moved to or out the other nodes or it is clusterhead.

Packet size (byte)	SDR with		CHSize improvement %
	LCA	CHSize	
64	0.883	0.912	1.033
128	0.871	0.889	1.17
192	0.937	0.940	1.003
256	0.920	0.946	1.02
320	1.010	0.976	.96
448	0.925	0.932	1.006
512	0.864	0.870	1.007

Table 7: Service Discovery Ratio with the LCA and with CHSize for multihops transmission.

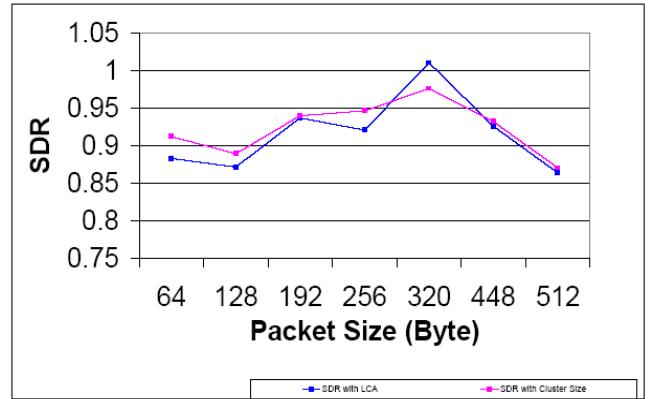


Figure 7: Service Discovery Ratio with LCA and with CHSize for Multihops Transmission

The service discovery ratio (SDR) was tested too; SDR represents the ratio between the total number of sent packets and the received ones (number of replies received). Figure 7 and Table 6 provides the service discovery ratio (i.e. packet delivery ratio) results as a function of packet size for both algorithms. The figure shows that the new proposed algorithm is better in service discovery ratio, the service discovery ratio for packet size 320 byte is the 0.97, which means the loss of service request packets will be decreased. the reason for this that each node requests a service will gets that services immediately through its clusterhead which has access to all the node(s)needed services provided to other clusterhead without the need of the request packets to be retransmitted.

IV COMPARISON SUMMARY

From the previous results and analysis, we conclude that clustered mobile ad-hoc network with CHSize algorithm has better performance than with LCA in terms of delay, number of lost packets while the LCA algorithm is better in energy consumption.

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Enhancing Patient Appointments Scheduling that Uses Mobile Technology

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Abstract— Appointment scheduling systems are utilized mainly by specialty care clinics to manage access to service providers as well as by hospitals to schedule patient appointments. When attending hospitals in Tanzania, patients experience challenges to see an appropriate specialist doctor because of service interval inconsistency. Timely availability of doctors is critical whenever a patient needs to see a specialist doctor for treatment and a serious bottleneck lies in the application of appropriate technology techniques to enhance appointment scheduling. In this paper, we present a mobile based application scheduling system for managing patient appointments. Furthermore, forthcoming opportunities for the innovative use of the mobile based application scheduling system are identified.

Keywords *Mobile application, Hospital, Appointment scheduling, Patient*

I. INTRODUCTION

An effective patient appointment scheduling system is very critical in hospitals to ensure effective and efficient service delivery in the health sector in Tanzania. Yet in order to target efficient appointment scheduling, there is a need for appropriate management and quality evaluation of the scheduling system. Most patients complain about the time spent between walking into the hospital and being attended by hospital staff, especially doctors. And this calls for proper handling. The proposed mobile application for patient appointment scheduling is poised to effectively facilitate delivery of health services in Tanzanian hospitals.

Making appointments over the mobile phone provides more benefits. These include time saving as staff spends less time in attending patients compared to paper-based appointments where patients need to fill in lots of forms. There is no waste of time in queues when a mobile application based patient appointment scheduling system is used. Furthermore, the automated appointment reminder in the mobile appointment scheduling system also saves time as hospital operators won't be required to call and send SMS to patients reminding them of their appointments. Mobile phone based appointment system allows for 24 hours convenient scheduling and patients can make appointments at any time compared to making

appointments physically by showing up at hospitals, which can be done only during working hours.

The World Health Organization (WHO) conducted a global survey in 2011 involving 114 nations and found that mobile devices are used in almost all countries but they vary on the uptake level: some use the mobile devices to send reminders to patients by sending text messages on their appointment, telemedicine, accessing patient records, monitoring patients and symptoms diagnosis [1]

There is an emphasis on the need to change in the way hospital services are offered by adapting e-Health technologies in order to achieve the national vision of applying information and communication technologies (ICT) in the health sector [2]. In one study, it was reported that waiting time for patients who attended their disability hospital appointments before receiving treatment was reduced due to enhancement of the system they implemented for triage patient appointment [3]. The hospitals' use of mobile technologies in scheduling appointments can facilitate rapid response; physicians can prescribe medication more safely, and there is high possibility of improving the patient's hospital records during daily clinic visits [4].

In solving patient waiting time, a discrete simulation model was proposed to illustrate how to improve clinic performance [5]. Based on dynamic and complexity of healthcare scheduling system when applying the simulation model, results show physicians' work time when combined with patient's admission time changing would reduce patients waiting time up to 73%.

Mobile appointment systems have been recommended for use in the health sector in order to improve the workflow, and as a result enhance scheduling of patients based on their priorities [6]. The patient's use of a mobile application system in making appointment allows him/her to request for appointment, negotiate with the clinic if the appointment is urgent, and choose his/her time preference among the available time slots [7].

This study's objective is to enhance the appointment scheduling system via a mobile application, which facilitates assigning time slots to patients whenever they make appointments and prioritize patients with high precedence. Patients who forget their appointments can receive a reminder

alert on the upcoming appointment, and the clinic can track appointments and health performance of their patients.

II. OVERVIEW OF THE APPOINTMENT SCHEDULING SYSTEM

In this section, we review the literature on the use of the mobile technology in appointment scheduling by hospitals. The primary objective is to find out exactly areas where improvement can be made to support the health landscape in Tanzania.

Appointment scheduling via paper-based system requires patients to be at the hospital, fill in registration forms and return them to the registration desk, and patients are then assigned to the desired doctor. Sometimes, patients place hospital identification cards or appointment cards in the dedicated box near the doctor's room, and then wait in the queue to be called by the nurse. Cards are placed in the order of first come, first serve (FCFS), whereby the patient who came early is the first to be served and the last to show up waits on the queue. Patient information in the paper-based appointment system cannot be easily corrected when changes need to be made: another form will need to be filled in, and the data entry registration desk staff experience problems in reading information written in the paper appointment forms, and it is difficult to retrieve patient details when required as you need the entire appointment application form ([8]). This type of appointment scheduling system has a range of constraints, such as patients being required to fill in appointment forms upon arrival at the hospital, and there is no possibility to register while at home or any place as a result, patients spend a lot of time waiting in queues, are required to follow dates of appointment assigned by the registration desk, and there is no mechanism for patients notification when appointments are postponed. Additional, managing paper-based hospital appointment system is difficult to manage, hence the need for a new method. The use of mobile appointment scheduling can enhance hospital appointments as it will allow patients to make appointments before going to the hospital. Patients can be reminded of the appointment as well. The clinic can monitor patient's performance while on the provided treatment, and the patient can select desired date of appointment based on his/her wishes.

Near field communication technology is a wireless communication that is used to transmit data at a short range of distance, approximately 10cm ([9]). The intelligent agent system was developed for appointment scheduling where patients can register and make appointments through mobile devices and eliminate the registration desk staff ([10]). Smart technologies for mobile appointment have been developed where patients use mobile and Near Field Communication Technology (NFC) ([11]). Patients need to tap their NFC cards into NFC readers at the main entrance gate of the hospital, and once there is an information match, the other scheduling procedures follows.

Ingagepatient.com is an online appointment scheduling system where patients need to register or sign up online in order to make appointments. New patients are required to have email accounts at the initial stage of registration. Once

registered, patients are required to fill appointment forms at their own pace without queuing.

To facilitate effective service delivery in hospitals in Tanzania, a mobile system for patient appointment is proposed where patients need to download and install the application in their mobile phones, and then they can register on the application and receive username and password which can be used for login in the application ([12]). After login, patients need to select filtration type, and a list of doctors is displayed based on the selected filter. Then, the patient is required to select a desired doctor and his/her schedule is displayed, and finally the patient can make an appointment based on the doctor's free time slot.

III. THE PROPOSED MOBILE APPOINTMENT

SCHEDULING SYSTEM

The proposed Mobile Appointment Scheduling System (MASS) aims at enhancing appointment scheduling in hospitals by allowing patients to register for appointments through mobile phones at their own time wherever they are, and make an appointment on their desired slot of time.

A. Requirements analysis

A modified wave appointment scheduling algorithm is a proposed approach for patient appointment scheduling in which patients are scheduled in 10 minutes and more than one patient is booked toward the beginning of every hour and the hour end is left open, permitting the specialist to make up for lost time, if needed. When the patient is attended to in less than the allocated time, the remaining time will be assigned to the next patient and idle time for waiting and doctor work overload will be reduced. Patient waiting time is expected to be reduced from 3 hours to half an hour. The modified wave scheduling will facilitate patient flow and rise patient satisfaction.

In order to accomplish the patient appointment request Fig.1 summarizes the involvement of actors and their collaboration among themselves and the system.

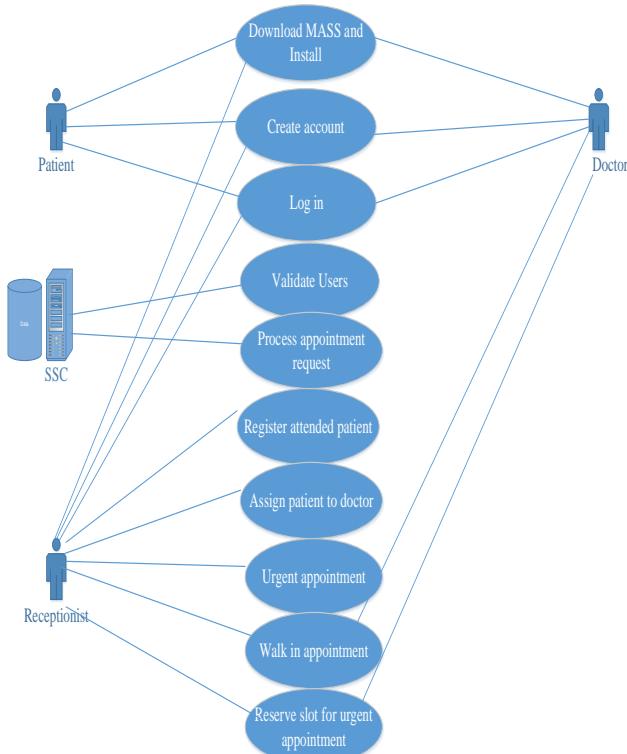


Figure 1. Involvement of actors and their collaboration among themselves and the system

B. MASS features

The proposed system will have a mechanism to display a list of available specialists and available slots, and provide notification of cancellation and postponed slots. The system will also have a mechanism for health tracking by monitoring patient's performance when visiting another hospital through retrieving the patient information from the database using the mobile phone. MASS can be used as an effective communication channel between the hospital and patients by communicating before the patient goes to the hospital. This system aims at helping patients by having appointment reminders and tracking appointments. For example, pregnant women will be provided with pregnancy tips from first week up to the last weeks of pregnancy with reminders for every appointment. After pregnancy, delivery, tips for clinic attendance will be provided through mobile phones, including reminders for attending the clinic as scheduled. Fig.2 shows the process flow for slot availability due to cancellation.

In your paper title, if the words “that uses” can accurately replace the word “using”, capitalize the “u”; if not, keep using lower-cased.

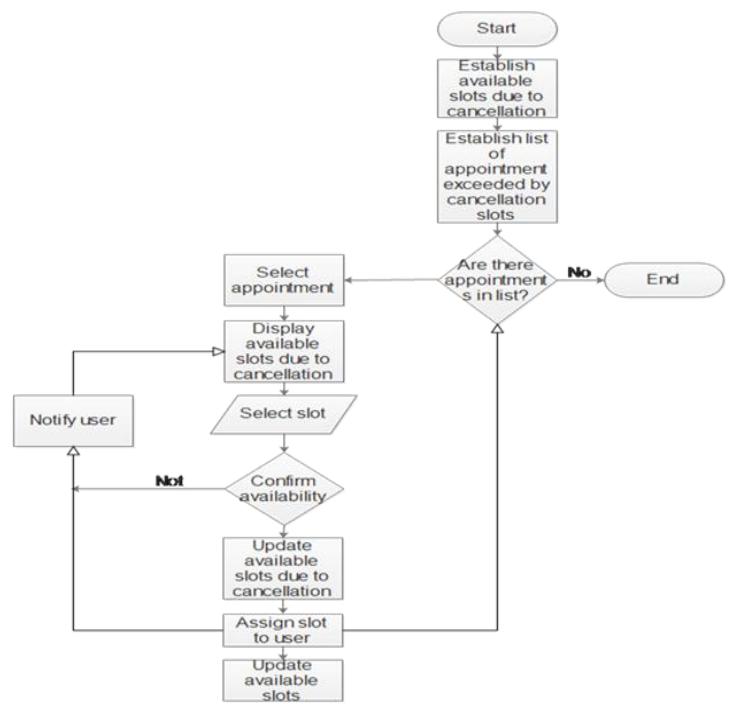


Figure 2. Process flow for slot availability due to cancellation

IV. DESIGNING MASS

A. Architecture of proposed mobile appointment scheduling system

MASS is designed into two panels: (1) patients, and (2) doctors (see Fig.3). At the initial stage, users need to download MASS and install it in their devices, create an account by signing up and receive a username and password for login. And once they log in, a welcome page will display a list of offered services and patients need to select any service on the list.

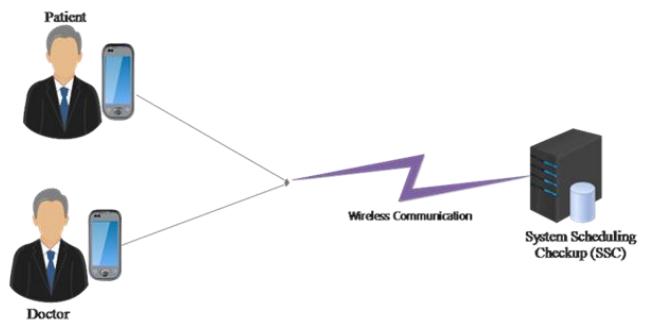


Figure 3. Architecture of MASS

The system scheduling checkup (SSC) is the center for patient scheduling and handling; it receives and processes all appointment requests. The main task of the SSC is to receive patient requests, process and assign the patient to a doctor.

B. Process flowchart after patient register successfully

In order to enhance appointment scheduling, MASS displays a list of medical specialists and the patient need to select a desired specialist. Once the specialist is selected, the system will establish and display available time slots and the patient is required to select the available slots. The patient has to confirm once a slot is selected so that the system can assign the time slot to the patient and update the available slots and remove the selected slot. If the selected time slot is not confirmed, the system will notify other patients about the availability of the time slot as shown in the process flow chart for appointment scheduling in Fig.4.

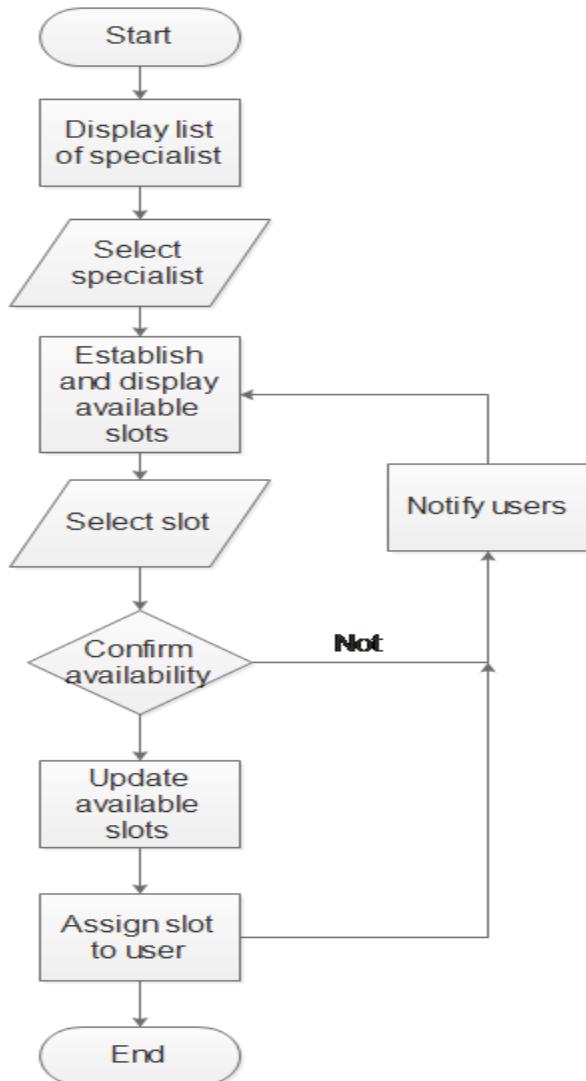


Figure.4 Process flow for appointment scheduling

During establishing and displaying available time slots, the system will display the doctor's name, schedule and timing, and it will also include detailed information of timeslot like date, month, year, time and duration to be attended. Fig.5 summarizes the data flow of information during establishing and displaying available slots, and Fig.6 when users select a medical specialist from the list of available specialists.

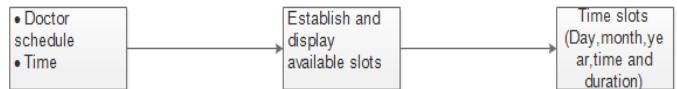


Figure.5. Data flow during establishing and displaying available slots

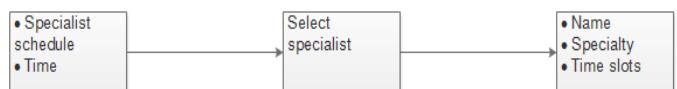


Figure.6. Data flow during functioning of selecting specialist

The overall system structure can be summarized by an algorithm shown in below.

	Procedure
Step 1	Users download MASS and install in their devices
Step 2	Users create account by sign up
Step 3	Log in using username and password
Step 4	Validate users
Step 5	Display list of specialist
Step 6	Select specialist on the list
Step 7	Establish and display available list
Step 8	Select slot
Step 9	Confirm availability
Step 10	If not confirmed then notify users availability of slot
Step 11	If confirmed then update available slots
Step 12	Assign slot to user and notify others
Step 13	End procedure

Table 1: Algorithm summary for overall system structure

V. DEVELOPMENT OF MASS AND RESULTS

In this section, we present the results for appointment scheduling using the mobile appointment scheduling system. Initially, the user needs to register in the system by signing up to the MASS and provide username and password, which will be required during the login stage. Before making an appointment, the user is required to log in by providing

username and password used during Sign-up and the system will validate the user's credentials.

A. Appointment by day

After successful log in, the system will display a welcome page with three functionalities and the user is required to select any displayed functionality. When the user wants to make an appointment and he/she knows the name of the doctor, the user can select an appointment by day and the system will display the list of doctors available and the user will be required to select any doctor that he/she wishes to see. Once the doctor is selected, the system will retrieve detailed information about the doctor's schedule which includes status, availability, time availability for an appointment, and the doctor's specialty as shown in Fig.7 and Fig.8. Thereafter, the user will need to select an appointed day, and the system will establish available free time slots. The user is then required to select any displayed slot from the dashboard and confirm the time slot by setting the appointment. The system updates the established time slot by removing the confirmed slot from other users.

After successful log in, the system will display a welcome page with three functionalities and the user is required to select any displayed functionality. When the user wants to make an appointment and he/she knows the name of the doctor, the user can select an appointment by day and the system will display the list of doctors available and the user will be required to select any doctor that he/she wishes to see. Once the doctor is selected, the system will retrieve detailed information about the doctor's schedule which includes status, availability, time availability for an appointment, and the doctor's specialty as shown in Fig.7 and Fig.8. Thereafter, the user will need to select an appointment day, and the system will establish available free time slots. The user is then required to select any displayed slot from the dashboard and confirm the time slot by setting the appointment. The system updates the established time slot by removing the confirmed slot from other users.

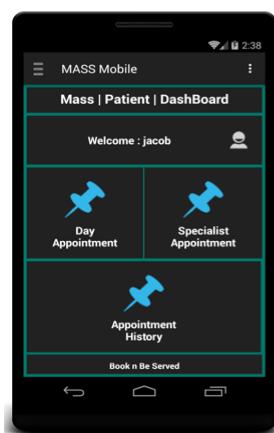


Figure 7. Welcome page

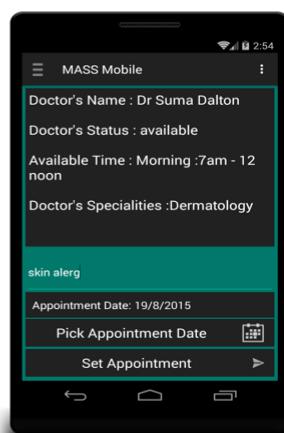


Figure 8. Set appointment Screen

B. Appointment by Specialty

When the user wants to make an appointment by choosing a medical specialist, he/she will be required to select the appointment and the system will establish a list of available medical specialists. Each medical specialty contains a list of available doctors. The user's selected desired doctor is displayed including the doctor's schedule. The user is then required to select a time slot from the available free slots established by the system, and confirm the slot so that the system can remove it from the available established slots as shown on Fig.9 and Fig.10.

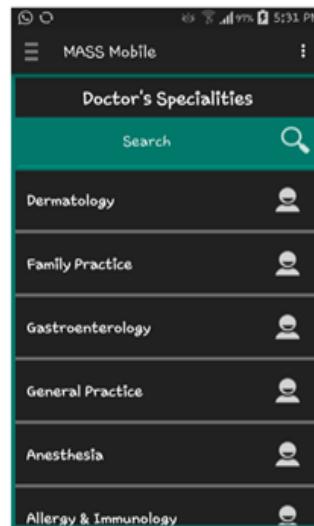


Figure 9. Doctors specialties

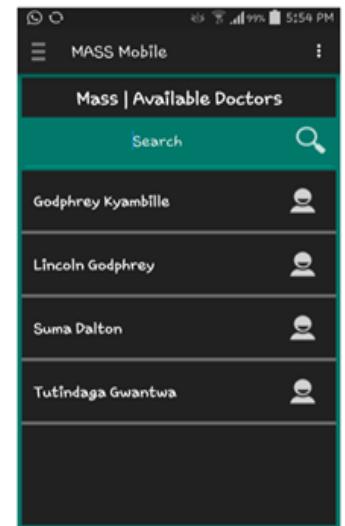


Figure 10. List of doctors

C. Appointment history

The mobile application scheduling system has a mechanism that allows doctors to retrieve patient history whenever the patient visits another clinic different from the previous one in order to understand the patient's response to previous treatment before providing him/her with any medical consultation. The system has a mechanism to retrieve and systematically organize the patient history/performance of the database. Traditionally, patient's medical history is attached to the hospital clinic card. When the patient visits another clinic, the clinic card is shown to a doctor in order to understand last the appointment history. For example, when a pregnant woman visits another clinic for monthly appointment, the system will have a mechanism to retrieve last appointment detailed information as it appears on the hospital clinic card.

VI. DISCUSSION

The design and development of the mobile appointment scheduling system was done using MYSQL with WAMP server and PHP. The database system is developed with MySQL which is an open source application possessed and

overseen by Sun Microsystems and gained by the Oracle Corporation. The scripting was done by utilizing PHP.

Let us consider an appointment scheduling scenario involving a patient cancelling an appointment. Once the patient is assigned a time slot successfully and decides to cancel the appointment, MASS will have a mechanism for notifying other patients on the availability of a slot for any patient that needs to reschedule an appointment. The system will establish the available time slots due to cancellation and display the updated available slots. Any patient making an appointment can select the available slots displayed and confirm to schedule the appointment so that the slot can be removed from the list. If the patient fails to confirm the appointment, the system will display the time slot to other patients as a free slot. In this scenario, MASS will enhance appointment scheduling by informing patients whenever there is free slot due to cancellation and patients whose appointment is deactivated by cancellation will be required either to select the available free slot due to cancellation or to remain in the existing timeslot.

Another scenario is for doctors postponing appointments with patients. Once introduced in hospitals, MASS will improve appointment scheduling by establishing the available time slots after a doctor postpones appointment. Postponing the appointments may create time slots which can other patients can use to see the doctor. In case of a doctor postponing appointments and therefore creating time slots to engage other patients, the system will check if there are appointment requests in the list. If pending appointment requests are found, then the appointments will be selected and a list of available time slots resulting from a doctor's appointment postponement will be displayed. The user will be required to select a time slot from the available slots and confirm to take the slot. Once confirmed, the system will update the available slots found due to the doctor's appointment postponement, and the selected slot will be assigned to the user. To avoid other users to choose the selected time slot, the system will notify other users by updating the available slots and hide the selected slot. If the user does not confirm the selected time slot, then the system will notify other users of the availability of the slot (see Fig.11).

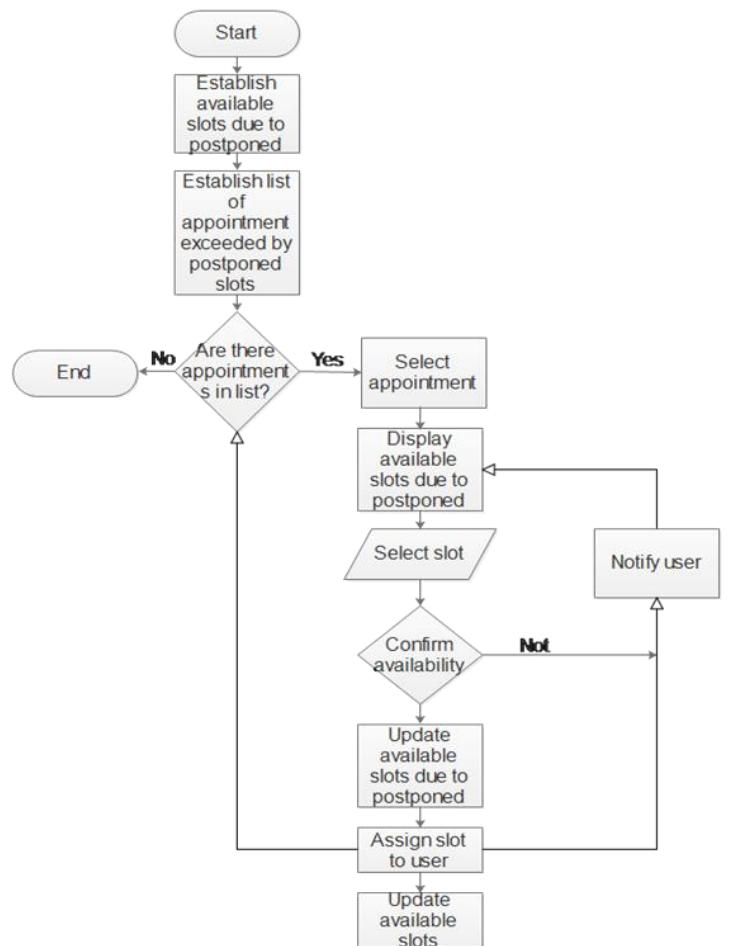


Figure.11. Process flow for doctor postponed appointment

VII. CONCLUSION AND FUTURE WORK

Scheduling appointments appropriately and resourcefully is vital to the smooth process of the hospitals' service delivery. Working in the new era of science and technology, people have the slight patience for waiting in the queue at the hospitals. Patients, who make appointments weeks in advance, want to be attended within 20 minutes after showing up at the hospital. They prefer to be given a specific time for seeing the doctor rather than arriving at the hospital and wait for an open moment. Doctors need a smooth tide of patients when attending the scheduled patients. Conferring the challenges facing existing patient appointment systems, we are proposing an integrated mobile appointment scheduling system that will enhance appointment scheduling in hospitals with the aim of simplifying patients and doctors' task. In our system, the SSC gathers information from the users and schedule patients based on the availability of doctor time slots. In employing the proposed system, patients will be more relaxed whenever they make appointments without standing in the long queue as the system would replicate tasks which would otherwise be carried out hospital personnel and patients. Doctors will be more comfortable in attending patients in a systematic flow as the system manages the appointment requests and scheduling. In future, the system can be developed to direct appointment

requests to another hospital where doctors with similar medical expertise are working. Moreover, providing automatic calls as reminders when the appointed day approaches or arrives is a vital feature of the system.

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An architectural design framework for Population Registration and National Identification System in Uganda

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Abstract— This paper presents an architectural framework to facilitate the development of an information system for Population Registration and National Identification System (PRNIS). A fully automated system of population registration which is amenable to the local needs of Uganda has not yet been implemented. The objective of this paper is to provide an architectural design model for the comprehensive, continuous, permanent and compulsory registration and identification of citizens and non-citizens in Uganda. Data used in developing this architectural framework for PRNIS was collected through interviews, observation and secondary sources. The study created an architectural model which can be used to develop a system for continuous registration of events, ascertainment of accurate statistics for population, provide proof of identity of citizens and create a repository for vital statistics in Uganda

Keywords—Architecture; population; national registration; identification system; ; vital statistics; data modeling

I. INTRODUCTION

An architecture framework deals with the design of a high-level structure for an information system. It results from assembling a certain number of architectural elements in some well-chosen forms to satisfy the major functionality and performance requirements of a system being designed, as well as some other, non-functional requirements such as reliability, scalability, portability, and availability [1]. A population registration defines a mechanism for the continuous recording of selected information pertaining to each member of a resident population of a country or an area. This makes it possible to determine accurate information about the size and characteristics of the population at selected points in time [8] [2]. An architectural design framework for modelling population registration and national identification system in Uganda is underscored by the fact that the existing system has not been fully automated, and as such manual processes are still largely in use in maintaining and accessing vital statistics in the country [abid].

A detailed analysis and data modelling for Population Registration and National Identification System (PRNIS), has already been presented in [2]. In this paper, we seek to present the architectural design framework for PRNIS.

An architectural model usually is based on components and relationships between components, indicating software modules, sub modules and details of needed functions for particular interfaces. Consequently, an architectural model serves as a communication aid between requirements engineers and system developers and also provides reliable basis for the development of an information system.

A. Problem Statement

A fully automated system of population registration which is amenable to the local needs of Uganda has not yet been implemented. The need for such a system has been discussed [2].

B. Objectives

The objective of this paper is to provide an architectural design model for the comprehensive, continuous, permanent and compulsory registration and identification of citizens and non-citizens in the country. Among others, the architectural design will:

- be used to develop appropriate population registration and identification system.
- be used to provide a valid and accurate statistical data on citizens and non-citizens and enhance birth and death registration when the system is fully developed
- serve as the basis for establishing a biometric register for identification of subjects in the system

C. Conceptual Framework

Figure 1 below shows the conceptual framework for PRNIS. There are four stages in the framework namely data, concept, process and output. The basic elements of each stage are explained in [2].

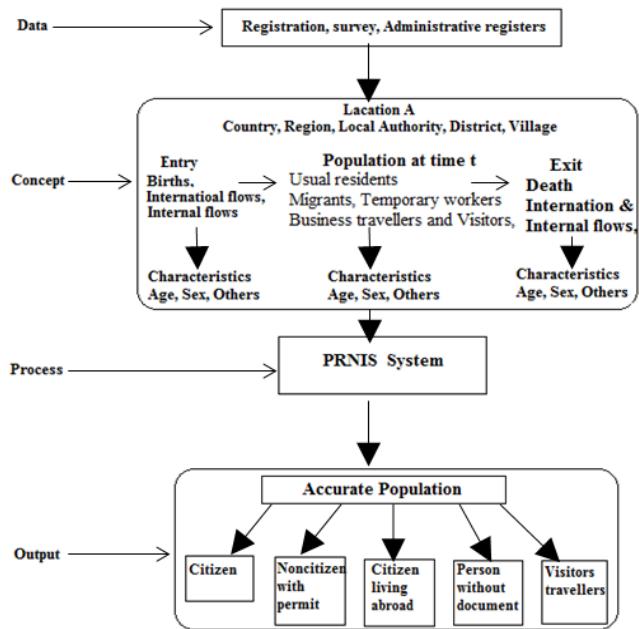


Figure 1 PRNIS conceptual framework (Ssegawa and Okike, 2015)

II. REVIEW OF RELATED LITERATURE

The term architecture is defined as the fundamental organisation of a system including its components and their relationship to each other and to the environment [3]. Various authors such as [4], [5], [6] consider architecture principles as essential elements of system architectures. Accordingly, an architectural framework provides principles and practices for creating and using the architecture description of a system. In specifying architectural design, key principles, special styles/conventions are followed as well as concepts and key assumptions that affect how the system is designed. A high-level block diagram of the layers of PRNIS is shown in figure 2 below. Therefore the Information systems architecture is a common framework, within which different kinds of individual information systems play respective roles and interact with one another [8].

A Layer comprises of related elements of similar capabilities and is highly independent of other layers it has very clearly defined interfaces and interactions in this case citizen and non-citizens are two separate layers.

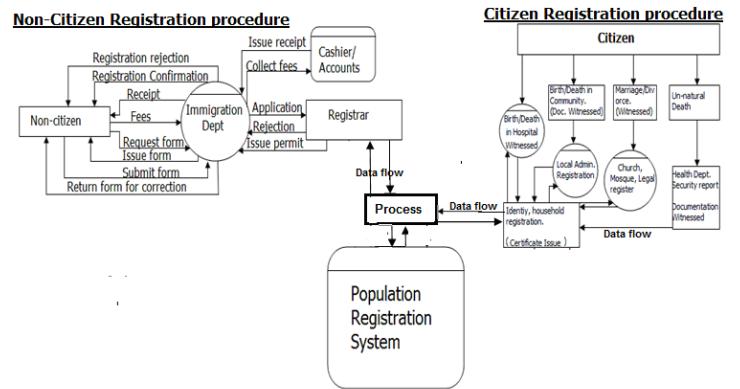


Figure 2 PRNIS Architectural Data flow Diagram (Ssegawa 2014)

III. METHODOLOGY

The current system of collecting, recording and maintaining population and national identification system in Uganda was examined and analysed. Selected personnel of Ugandan Bureau of births and deaths were interviewed. Furthermore, appropriate documents were consulted and analysed. Data collected from the relevant sources were analysed and used to create the data model of the system. Through out the modelling phase of this work, the objectives of the study were kept in appropriate view.

Figure 3 summarizes the overall study design, activities and the extent of data requirement and utilization for the study [2].

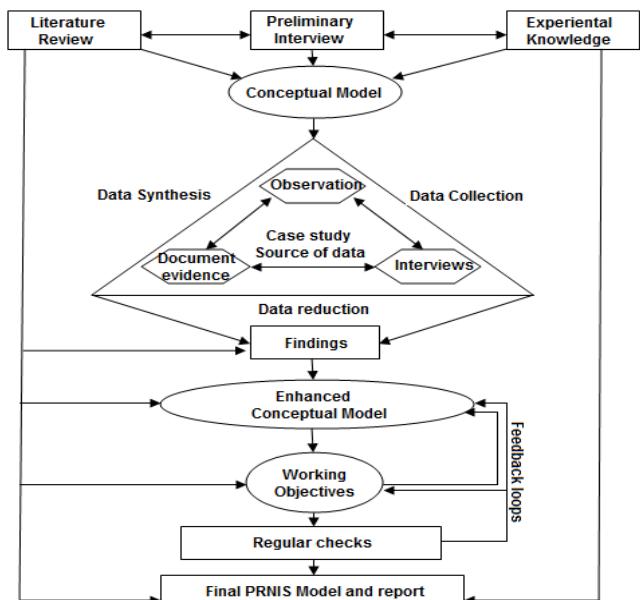


Figure 3 Study design of PRNIS (Ssegawa and Okike 2015)

The study design summarizes data collection approach which includes literature review, interviews, and observation, development of data model, and PRNIS final model as presented in [2].

IV PRNIS SYSTEM ARCHITECTURE

Figure 4 below shows the system server architecture structure of PRNIS. The system architecture is a three-layered model including Browser server, Web server, and Database server structures. The Browser serves as client application, responsible for displaying information and data collection, communicating with web server through the Internet and realizing the interaction of information between the user and systems.

In addition, the Browser Server, provides Internet access to the database server which is limited to users with privileges. It has three-step responses to clients; First it accepts the connection, and secondly it reads and processes the client's requests and lastly, it sends replies to clients. Since requests may take time to process, the browser server is multi-threaded in order to handle concurrent requests. A single request leads to multiple replies, therefore the advantage is that the browser server operates as long as there is Internet access. The Web server is in charge of the main application processing tasks. It is responsible for the business logic operations of modules and information issues including Hyper Text Transfer Protocol (HTTP) requests, connection and interaction with database server. The Database server is responsible for storage and management of system data.

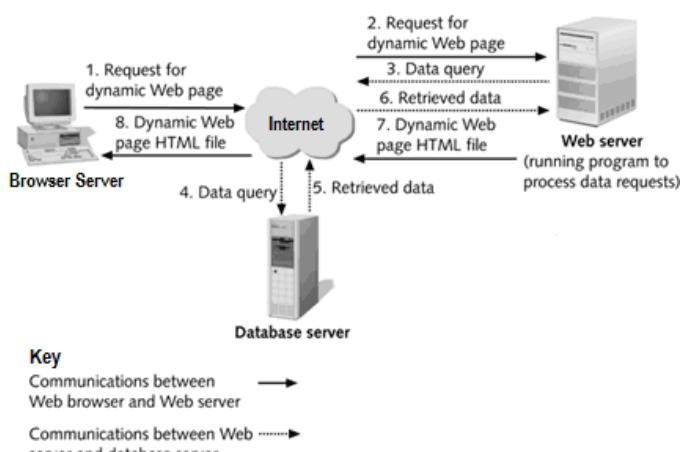


Figure: 4. PRNIS Servers structure architecture

The Web-server receives requests, converts them into SQL statement and submits to database server which verifies the validity and deals with the data, and then returns the results back to the web server, which in turn handles the data logic operation of various functions according to the demand and eventually transfers the results.

Figure: 5 below presents the technological architecture. Remote/mobile clients access web portal through Internet and Global Positioning System (GPS) connections to register, send requests, receive SMS notifications and display information from the system.

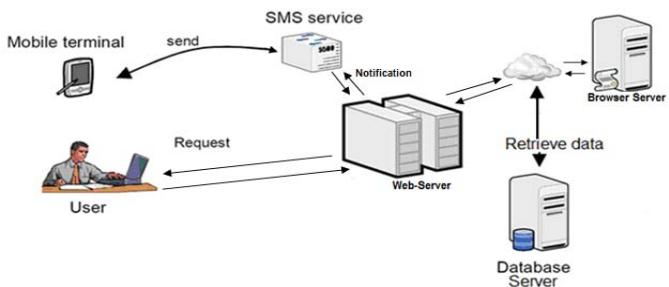


Figure:5 PRNIS Technological architecture

The advantage of this architecture is that, when the user wants to register or retrieve data, the user on web portal requests the web server, the web server asks the browser server and the browser server queries the database server. In turn, the database server delivers record-sets with all the data requested for. The browser server application does all the processing to determine the data and delivers up the final data to the web server. The web server displays the final information to the user (client).

V. THE ARCHITECTURE MODEL OF PRNIS

Since a concept might map to multiple semantics by itself, an explicit formalization is usually required for identifying and locating the intended semantic from several candidates to avoid misunderstandings and confusions in conceptual models. The system conceptual modelling in this case presents graphical models of the system based on the fact-finding, the three-tier architecture of the PRNIS system are explained as follows;

1. Web server known as Presentation Tier: it interacts closely with the user (client). Occupies the top level and displays information related to services available on a website. This tier communicates with other tiers by sending results to the browser and other tiers in the network.
2. Browser server known as Application Tier: Also called the middle tier, business logic or logic tier, controls application functionality by performing detailed processing.
3. Database server also known as Data Tier: This is the most critical aspect of the system; where the user data, operational data and metadata are stored for easy access and retrieval. It houses database servers where information is stored and retrieved. Data in this tier is kept independent of browser server or business logic. Thus, a database is an organized collection of structured data, to serve many applications with minimum redundancy.

VI. PRNIS DESIGN FRAMEWORK

System design is the creative process of transforming a real-life problem into a solution. This is done through the description of the structure of the software to be implemented, data which is part of the system, and the interfaces between system components. For this system, the structure is

represented through its logical design and functional decomposition. The logical design specifies the methods of interaction of system components like the input and outputs, menu structures, procedures, controls and functions and command structures. For this population registration system, it comprises of three essential modules, namely: the user module, the system administration module and the registration module. While a decomposition diagram below shows a top-down functional decomposition of a system and exposes the system's structure. The objective of the Functional Decomposition is to break down a system step by step, beginning with the main function of a system and continuing with the interim levels down to the level of elementary functions.

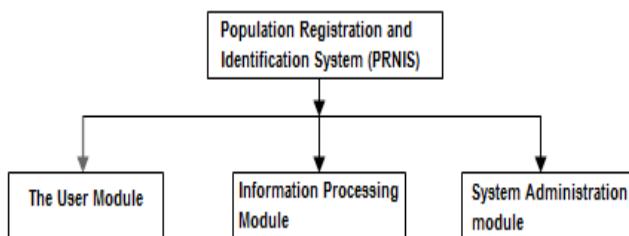


Figure:6 Architectural Design of PRNIS

Figure 7 below shows the decomposition of PRNIS architectural design which represents the functional process module of the system.

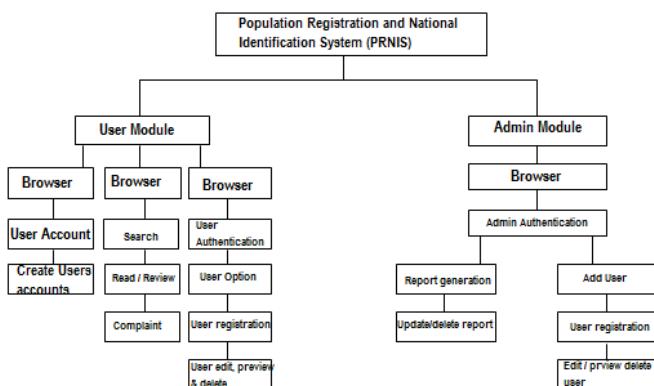


Figure:7. Functional decomposition diagram

Functional Process models describe the relationships between activities and the information that is used to perform each process. The approach reflects a hierarchical design whereby each process is gradually refined to reflect greater levels of detail.

VII. THE INTERFACE DESIGN

Login Module – This is the Login page through which administrator, user or specified user with national ID can be granted access the system. Both admin and users may be denied access until a valid ID number is entered and password.

Login module is the gateway to this system after the domain (www.pnris.go.ug).

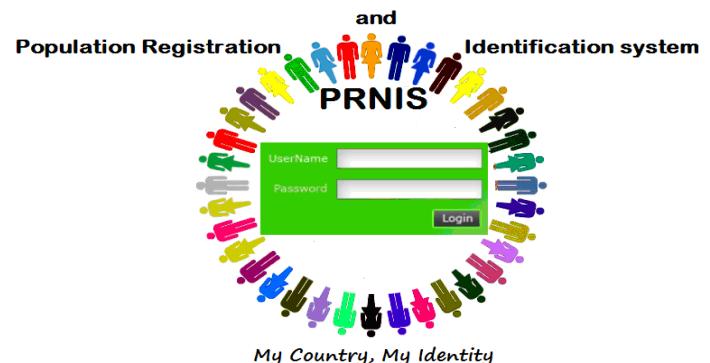


Figure 8: Login module (Ssegawa, 2014)

After the user has entered a valid National ID Number and Password, and it has been authenticated. He/she is allowed to access the system. The user can either choose to register an individual, view an individual's records, delete an individual, or update individual details, depending on the authenticity of the user.

PRNIS MENU PAGE

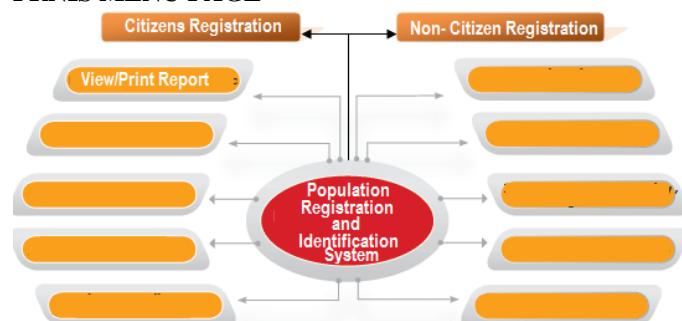


Figure: 9 Shows expected menu page

Registration module

After clicking on the register icon, the system navigates to a form where the user is required to fill in certain information about the respondent as pre-requisite to registration. Individuals are grouped into categories which the user is required to select one between Children registration (an individual below 18 years), adult registration (an individual above 18 years), or any other categories of vital registrations such as birth, death or non-citizen registration category.

For new registration for citizens, a personal national identification number serially generated automatically. As shown in figure 9.

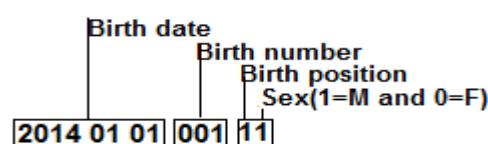


Figure: 9 Sample PIN (Ssegawa 2014)

Identification Number: Each person who is registered in the population records must have a personal identity number as an identifier code. A system based on date of birth and three digits birth number plus one digit for birth position in the family and one for sex. A person who has once been given a Personal Identity Number retains it for life unless it has to be corrected as a result of some error in numbering. So the personal identity number is not changed on, for example, moving into or out of Uganda.

A person, who was born on **01st Jan, 2014**, was the first to be registered for that day and being the first born in the family and male, the PIN appears in this format 2014010100111.

Birth number: The birth number consists of three figures. It is a number ranges from 001 - 999 shows the number of people born on the same day. The combination of the figures for the date of birth and different numbers for those born on the same day ensures that all people receive different identity numbers.

Birth position: This figure makes it possible to check the position of the new born in the family and links a child to the mother. The last number toggles between 0 and 1 indicating either M or F.

Non-citizen Registration

Non-citizen registration form is another category from admin home. This category has a constraint that accepts only visa/permit number and international passport. Admin enable to register all non-citizens arrived to the nation legally. Non-citizens without proper documents have to through legal authority in order to get registered.

PRNIS DATABASE DESIGN

The database for PRNIS follows from the E-R as shown in figure 10 below.

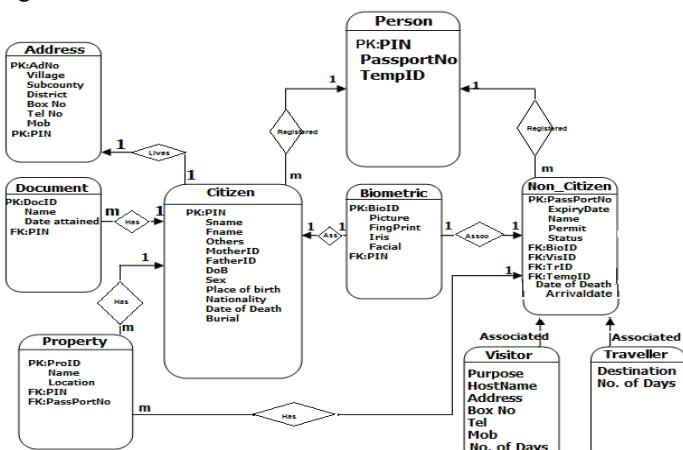


Figure: 10 E-R Models (Ssegawa and Okike 2015)

The Entity Relationship Diagram (ER Diagram) is used to represent Entities, Attributes, Relationship and cardinalities.

The dependencies are identified the data arranged into logical structures and mapped into database schemas. The logical database design simply means the ER diagram is converted to relational tables. Each Entity corresponds to a Table. Attributes of entities correspond to fields in relational tables. Normalization has performed to make the relations in appropriate normal forms. The physical database design has been implemented as a database management system. It includes the specification of data elements, data types, indexing etc.

PRNIS SCHEMA

CITIZEN	PIN	Fname	Sname	Others	MotherID	FatherID	DateofBirth	Sex	PlaceofBirth	Nationality	DateofDeath	BurialPice
BIOMETRIC												
Bio_ID	PIN	PassportNo	Photo	FingerPrint	Iris	Facial						
NON_CITIZEN												
PassportNo	Name	ExpiryDate	PermitNo	ExpiryDate	DateofDeath							
PROPERTY												
ProID	PIN	PassportNo	ProName	Location								
DOCUMENT												
DocID	PIN	DocName	IssueDate	Issuer								

Figure: 11 The database schema

Citizen (PIN, Sname, Fname, Others, MotherID, FatherID, DoB, Sex, PlaceofBirth, Nationality, DateofDeath, PlaceofBurial)

Noncitizen (PassportNo, ExpiryDate, Name, Permit, Status, DateofDeath)

Biometric (BioID, PIN, PassportNo, Picture, FingPrint, Iris, Facial)

Property (ProID, PIN, PassportNo, Name, Location)

Document (DocID, PIN, Name, DateAttained, Issuer)

PRNIS HARDWARE REQUIREMENTS

The entire hardware requirements for PRNIS are presented in the figure 11, below to provide the data processing system. These include: Web-Servers, WAS-Servers, SAN switches, data storage devices, backup equipment, data replica, mail/SMS server, backbone switches, firewalls, VPN gateway, W/G switches, and Internet routers.

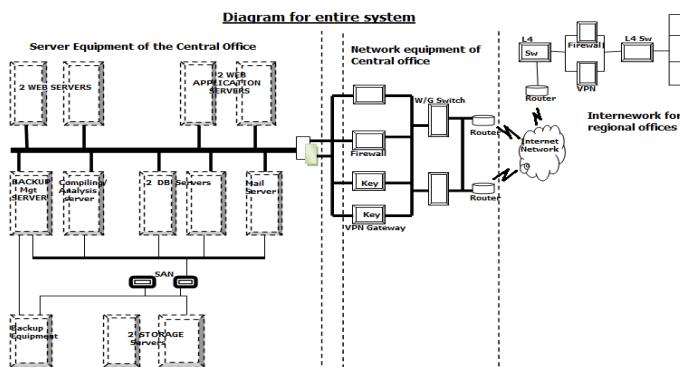


Figure: 12 Hardware architectural designs (Ssegawa, 2014)

Architecture for solving the problems of the Client/Server system in which the presentation of the Web server, the application processing of the WAS server and the data management of the DB server are logically separated, as presented below:

a. WEB Server: A computer program that is responsible for accepting HTTP requests from web browsers, and serving them HTTP responses along with optional data contents, which usually are web pages.

b. WAS Server: (Web Application Server): Middleware (software engine) that serves to perform application programs through HTTP on the Internet in client devices or equipment. Contrary to the web server, dynamic contents such as Java EE, .NET are performed.

c. Partitioning: A physical server is divided into several logical servers. Each partition is operated independently by its own OS. Through dynamic partitioning technology, resources such as CPU, memory and IO assigned in each partition will be added, deleted or relocated according to service situations.

d. Active-Standby: A dual system of either active or standby mode. To increase the availability of the Database server, the DBMS is composed dually. Owing to this composition of physically high availability, the standby server replaces the Active Database server in case of system failures.

e. SAN Architecture (Storage Area Network Architecture): A comprehensive network architecture in which different kinds of data storage devices are connected to a data server.

f. SSD (Solid State Disk or Drive): Data storage devices that use semiconductors. Data are rapidly exchanged and the drives are silent.

g. Backbone Switch: A high-capacity switch position in the physical backbone of a network

h. RAID (Redundant Array of Inexpensive Disks): A technology that stores some repetitive data into several hard disks to achieve high levels of data reliability. In preparation

for system failures and to enhance the reliability and stability of the system, major components of hardware are dualized. The Operating System (OS) of the servers designed to prepare for physical disk failures by the RAID (Mirroring) configuration.

i. Backbone: Fibre channel for high speed data transmission.

PRNIS NETWORK ARCHITECTURE

Figure 12 below describes the network configuration requirement for a secure PRNIS. It provides communication between the servers and the clients.

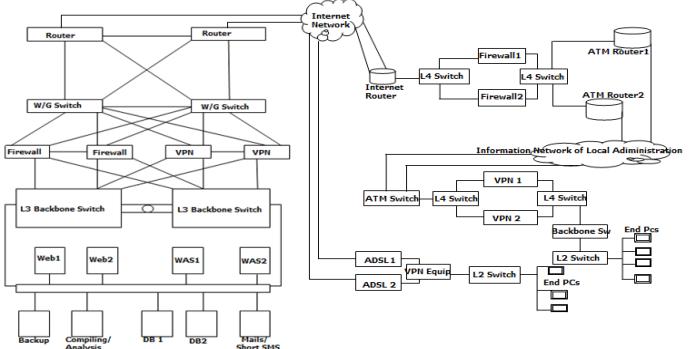


Figure: 13 Network architecture (Ssegawa, 2014)

Security Architecture

Configuration for a secure PRNIS is described in the figure 13 below, showing security at layer 3 switches.

DMZ (DeMilitarized Zone): A sub network comprising of firewalls located between the Intranet and the Internet to reinforce security.

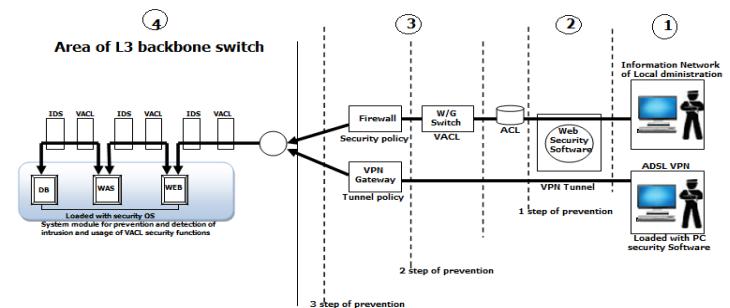
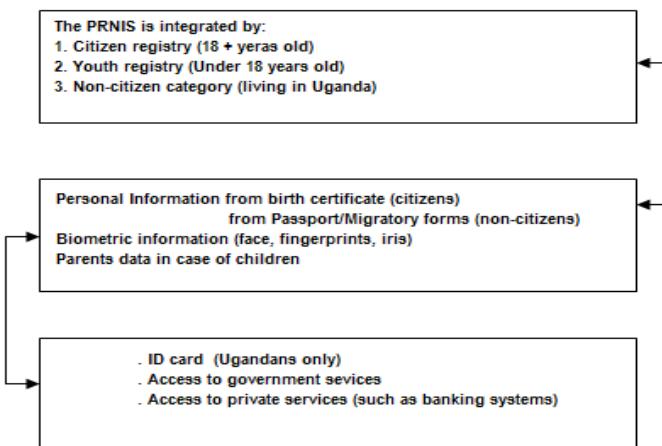


Figure: 14 Security architecture (Ssegawa, 2014)

PRNIS SAMPLE OUTPUT

Figure 15 shows an example of expected sample output from the system.

a) National Identification Services



- Information for both citizen and youth registry is integrated and used by all units in public administration.
- Non-citizen category is integrated by migration institution
- ID card will have fingerprint minutia encoded in a 2D barcode for offline identification.
- Web services are available for online identification

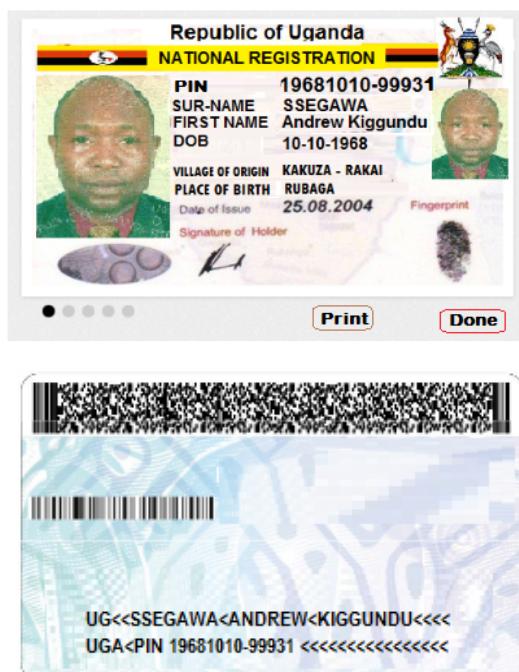


Figure: 15 Sample Identification (Ssegawa, 2014)

b) Population Model

PRNIS architectural design guarantees of having accurate population data, which is computed from differential equation and exponential growth equation as shown below:

$$P_t = B_t \pm EI_t - D_t + T_{t-1} \quad (1)$$

Where

P_t =	Accurate Size of population at time t
B_t =	Additional Births at time t
EI_t =	Addition or Subtraction Migrants at time t
D_t =	Subtract Deaths at time t
T_{t-1} =	Addition of existing Population at time t

When birth rate and death rate are taken into consideration, it's possible to combine them to produce a value that reflects the overall net rate of population change as shown in equation 2.

$$\begin{aligned} b &= \frac{B_t}{P} \Rightarrow B_t = bP \text{ and } d = \frac{D_t}{P} \Rightarrow D_t = dP \\ Pt - P &= (b - d)P \end{aligned} \quad (2)$$

Note: r is a rate! And $r = b - d$, $0 \leq r \leq 1$

This model gives the accurate population, total births, total deaths, total immigrations and total emigrations.

DISCUSSION

The Population Registration and National Identification System (PRNIS) for Uganda proposed is a uniform database of the personal data of citizens and non-citizens. The data is useful in performing the tasks assigned to institutions of the state and the local governments as well as physical and legal persons. The benefits are diverse and include the following.

- Fighting identity fraud,
- Border control and immigration flows,
- Verification of entitlement to services and benefits,
- Crime prevention,
- Anti-terrorism, and
- Organizing of elections.

Proper identification of citizens becomes a central issue when faced with the need to issue secure identity documents such as passports, ID cards, entitlements, social benefits, voters' cards, driver's licenses, turning an e-government strategy into reality, organizing fair and transparent elections or improving the citizen satisfaction of any government service. Unique and unambiguous identification of citizens and residents in Uganda is a corner stone of an efficient public administration. In return, citizens are provided with quicker and better quality of services.

CONCLUSION

A modern population register is built on the basis of proper data model and cut edge technology, integrated to form a coherent system for enrolling, registering and storing citizen and non-citizen data. Once the population register is established it becomes the unique reference source for identity information. In turn, it can be used to create many other registers which provide alternative decennial census. With the models presented in this study, the basic requirements of the PRNIS system have been identified and modelled. This model is suggested for use in the design and implementation of a working population registration and national identification system (PRNIS) in Uganda.

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Student Modeling for Arabic Language Skills in Intelligent Language Tutoring Systems

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Abstract— Language Tutoring Systems (LTSs) are computer based tutoring systems that concerned with learning languages. Most of LTSs are based on natural language processing tools for analyzing the student response to support him/her with suitable feedback. However, such systems (especially for Arabic language) don't consider modeling of the student knowledge. Therefore, these systems cannot personalize their interactions to each student needs and preferences. This paper presents a technique for modeling the student competence in Arabic language skills. Arabic language skills for grade four in primary stage are addressed. We defined and sorted these skill according to their difficulties. In addition, a number of domain constraints are defined where the student answer to system presented questions are tested against them. Satisfied and violated constraints are used to model the student competence in the selected domain skills. The student model can be used to adapt the system interactions according to the student weak points to enhance his/her Arabic language skills.

Keywords- *Intelligent Tutoring Systems; Intelligent language Tutoring Systems; Constraint Based Student Modeling.*

I. INTRODUCTION

Intelligent Tutoring Systems (ITS) are computer based tutoring system that are characterized by personalizing their interactions to each student needs and preferences. ITSs involve the student in an active learning environment, aiming to match the effective learning outcome of an individual tutor [1]. ITSs provide adaptable support to each student based on modeling of the student knowledge and characteristics [2]. The student model is deployed in the personalization of the system interactions, such that it provides student-specific feedback or selecting the next problem to solve.

The Student model represents information that specific to each student. It grants the ITS with the adaptability to reach the effectiveness of the individual-tutor systems. The student model does not have any specific action responsibilities; it is used as an input to the other modules, for example the pedagogical module use the stored information in the student model to reach decisions like when student should move on to the next section of the curriculum [3].

There are different student model forms like model-tracing, perturbation, constraint-based models. Model-tracing technique is based on using production rules where all rules that have been applied with high success rate assumed to be learned [4].

That technique requires modeling of all alternative solutions and specifying each solution path with specific production rules [5, 6]. In the perturbation model, not only the student knowledge is represented but also his/her misconceptions, or “buggy knowledge”. Therefore, the domain model must contain information about the misconceptions that students may have. Constraint-based modeling (CBM) is the simplest way to represent the student model in this manner. In the CBM, knowledge is represented by identifying the principle of the domain and the properties of the correct solution to the problems. We adopt the constraint based modeling approach because its simplicity and convenient with the domain nature.

Different domains such as Math, Physics, and Computer Programming have been utilized in implementing ITSs [7, 8]. Learning languages domains attract a lot of research and emerge what is called Language Tutoring Systems (LTSs). These systems deal with different linguistic skills such as sentence construction, various inflection rules, vocabulary and grammar practice.

LTSs vary in their capabilities according to their components and using of Natural Language Processing (NLP) tools. NLP is one of the Artificial Intelligence fields that interested in interpret and process human natural languages [9]. Systems use Natural Language Processing (NLP) tools has the ability to evaluate the student answer and diagnosing his/her misconceptions. In sequence, systems based on NLP can support the student with adequate feedback that figure out his/her errors and their reasons [10, 11]. On the other hand, systems that implies student models have the adaptive capability to tailor the presented exercise and feedback to each student. [12, 13]

Arabic is a Semitic language spoken by more than 330 million people as a native language. Arabic is a highly structured and derivational language where morphology plays a very important role [14, 15]. Over the last few years, Arabic natural language processing (ANLP) has gained increasing importance, and several state of the art systems have been developed for a wide range of applications such LTS [16, 10].

This paper presents a student modeling technique to model the student Arabic language skill within an Intelligent LTS (ILTS). The proposed modeling technique is based on constraint-based modeling with some modifications. Moreover, presented system exercises are categorized according to the

used language skills which are sorted by their difficulties. Therefore, the system has the potential to adapt the presented questions according to the student model.

The selected domain for this system is the Arabic grammar rules for fourth grade in primary stage. Different skills are covered in this course. The main contributions of this paper is defining the required Arabic language skill with sorting them according to their difficulty levels. In addition, constraints based modeling technique for assessing the student in the defined different language skills is presented. The next sections will focus and give more elaboration for these two contributions.

The rest of the paper is categorized as following; next section explores the related work that focus on the LTS and the different student modeling techniques. Section three demonstrate the proposed system “Intelligent Language Tutoring System for Arabic (ILTS)” and their components. Definition and categorization of the considered Arabic language skills are addressed in section four. Section five deal with the proposed student modeling technique. Conclusion and future work is included in section six.

II. RELATED WORK

ICAL and ILTS have been implemented for various languages such as English, German, Chinese, Arabic. These systems are vary in their capabilities, language skills, student model and learning strategy. We will explore some of them in the next sections.

A. Marathi E-Guru

Marathi E-Guru [11] is a Language Tutoring System (LTS) to teach an Indian language. The system focuses on teaching constructing sentences which need the student to be familiar with various language constituents, their positional choices and how these language constituents get inflected with change in the other constituents. The system has pedagogical strategy which relays on interactive scaffolding to avoid parser based analysis of student response. Scaffolding mechanism is based on asking the student to constructing the Right form of a Verb or constructing the right form of a pronoun. The system provides hints whenever required, analyses error (if any) in the student’s response, and provides necessary feedback. The limitation of the system is that it does not have a student model, thus making the exercise generation process doesn’t target the student weak points.

B. Telugu language tutoring system

Telugu language tutoring system architecture is based on Marathi E-Guru [11], with an extension of student model [12]. The proposed student model is the overlay of domain knowledge with representing the student confidence level of applying each rule on a scale of good-average-weak-poor. The main focus of the proposed student model is to capture the student knowledge level while the student is solving exercises and generate exercises in weak areas. The tutor checks the student model to find the rule with confidence level less than or equal to threshold to generate an exercises. However, the

system domain is limited on applying noun and verb inflection rules. Moreover, diagnosing of errors is basically based on assuming conflicting between rules.

C. Web based German tutor

The web based German tutor [13] solving exercises on vocabulary, inflections and sentence generation. It presented generality error detection algorithms that are not limited to a particular native language user group. The algorithm is based on different answer checking modules where each module is responsible for different error classes and operates independently. In addition, the domain knowledge has Natural Language processing capability to parse the student answer and provide the error specific feedback. Individualization is achieved through a dynamic Student Model that modulates feedback messages and provides remedial tasks suited to learner expertise. The limitation of the system is that the actual exercises generated are not sorted by difficulty level and in sequence can’t be adaptively selected according to the student proficiency level.

D. CALL system

CALL system describes the development of a computer-assisted language learning system for learning Arabic using natural language processing (NLP) techniques [10]. It provides grammar practice for learners of Arabic. The learners are stimulated to enter freely his/her response as sentences in various situations and contexts. The system is based on NLP tools including a morphological analyzer and syntax analyzer in addition to an error analyzer to give the adequate feedback to the learner. The system augment the Arabic grammar with rules (buggy rules) which are capable of parsing ill-formed input and which apply if the grammatical rules fail. The system limitation is the absent of the student model, difficulty levels of the questions are not defined, and exhaustive work is required to construct buggy rules to consider all possible student errors for each question type.

III. ARCHITECTURE OF ILTS

Fig. 1 shows the proposed ILTS system architecture. The system consists of the following subsystems: user interface, knowledge base, question module, constraint based modeling, and student model.

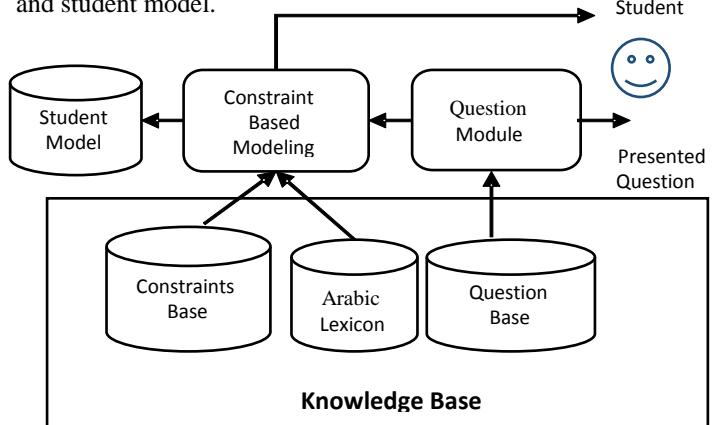


Figure 1. ILTS architecture

A. User Interface

The user interface provides the means of communications between the student and the ITLSA system. It is used to present the question and deliver the feedback to the student.

B. Knowledge Base

Knowledge base has three components; constraints base, Arabic lexicon and question base.

The constraints base implies the set of defined constraints that cover the selected domain skills. Each constraint focuses on one aspect of the question solution that require a specific skill. Although that increases the number of constraints, it provides fine determination of the student errors and allocate a feedback message for that error. On the other hand, question database contains the different questions headers which implies the required skills to be solved in addition to different questions bodies for each question header.

Lexicon is a representation of selected domain words categories with definition of the different set of features. Lexicon is an important component in Arabic languages where different morphological rules and syntactic rules are based on the word category and features.

Arabic lexicon has a definition of the selected domain words categories. We consider three basic morphological categories for Arabic; noun, verb, and particle. Each with a different set of features. The following describes the forms of the lexicon noun, verb, and particle.

- **Noun:** Stem, Category, Sub-category, Gender, Anatomy, Number, and Irregular plural.

Where

Stem: 'Arabic-noun'

Category: noun

Sub-category: demonstrative, proper noun, common noun

Gender: feminine, masculine/neuter

Anatomy: person, animal, plant

Number: singular, dual, plural

Irregular plural: 'Broken plural form'

Examples:

Lexicon ('طالبة'), [stem: 'طالب'], category: noun, sub category: demonstrative noun, gender: feminine, number: single, Irregular plural: [طلاب]).

- **Verb:** Stem, Category, Gender, Number, Tense

Where

Stem: 'Arabic-verb'

Category: verb

Sub-category: demonstrative, proper noun, common noun

Gender: feminine, masculine/neuter

Number: singular, dual, plural

Tense: past, present, future

Examples:

Lexicon ('شرب'), [stem: 'شرب'], category: verb, gender: masculine, number: singular, tense: past])

- **Particles:** Stem, Category, Sub-category

Where

Stem: 'Arabic-noun'

Category: particle

Sub-category: conjunct, preposition

Examples:

Lexicon ('و'), [stem: 'و'], cat: particle, Sub-category: conjunct])

C. Question Module

Question module that retrieve the question header and body from the question database. In this stage the retrieving process is randomly selection among different questions defined for each domain concept.

D. Constraint based modeling

Constraint based modeling has the responsibility of testing the satisfied condition constraints against the student answer to define the satisfied and violated constraints.

E. Student model

Student model records the history of each constraint. This record implies information about satisfaction or violation of the relevant constraints against the student answer. This information is accumulated in three fields, called relevant constraint id, satisfied number and violated number. This record describes the student confidence level for each constraint. This information can be used by the pedagogical module to adapt the question selection.

IV. ARABIC LANGUAGE SKILLS OF THE DOMAIN

The selected course include Arabic grammar concepts for grade four in primary level. Specifically, they cover the following concepts:

Nouns, verbs, particles, demonstrative nouns, pronouns, dual, plural, nominal and verbal sentence, and, agreement of verb with the object

الأسماء، الأفعال، الحروف، أسماء الإشارة، الضمائر (ضمير المتكلم، ضمير المخاطب، ضمير الغائب)، المثنى، الجمع، الجملة الإسمية، الجملة الفعلية، توافق الفعل مع الفاعل.

Exercise that deal with these concepts are varying in the required skills to solve. We categorize the skills from the linguistic view and according to their difficulties to three main categories; i) Identifying features skills, ii) morphological skills, iii) syntactic skills. Syntactic skills are the most

complicated one. It implies different sub skills. We will shed some light on each skills category in the next subsections

A. Identifying features skills

Student has to know some features of the word such as its category, gender, number to deal with it in the different situations.

Identifying features skills focus on characterizing the word within the available choices according to the required feature(s) or suggest word has the required feature(s). Different questions deal with this skill category across different concepts. For example the question may ask about the word category for the word categories domain lesson, or ask about demonstrative nouns or pronouns etc.

Questions with different forms are implemented to cover this skill for different word categories. For example, different question headers to check different word categories are as following

- Check demonstrative name in the following sentences.
- Select the first pronoun in the sentence
- Check the nouns in the following sentences.
- Select verb and put it in the following sentence.

Figure 2 shows the last example, it ask the student to select a verb and put it in the sentence. It is worth mentioning that the available choices contains only one verb and the others are nouns or particles, that is to focus on the skill of identification only.



Figure 2. Example of the verb selection

B. Morphological skills

Morphology is science of conjugating words into different forms due to the intended meaning. Morphology is only applied to nouns and verbs because they are able to be conjugated into different forms, but prepositions are not able to be conjugated, rather they always remain in one form. Morphology is applied to verbs by conjugating them from tense to another tense or to different gender. Morphology is applied to nouns by conjugating them into the dual and plural forms.

In the considered domain, morphological skills are restricted to changing in count (dual or plural) and changing in gender.

We have different forms of questions that assess the student morphological skills. For example

- Change the following words to dual.
- Write the plural form of the following words

C. Syntactic skills

Syntactic skills mean known the grammar rules or skills to constructing grammatically correct sentence in Arabic. There are three main related skills i) identifying word constituents according to certain syntactic feature ii) identify sentence type and, iii) constructing sentence. Constructing sentence implies different sub-skills such as check words categories or sentence type, consider the agreement between word and next word according to the context, change from sentence type to another type

Different questions handle syntactic skill in its various forms; such as

- Check the object in the following sentence.
- Check the nominal sentence
- Change from nominal sentence to verbal sentence
- Complete the sentence with suitable demonstrative noun.

First question ask about the word constituents as an object in the verbal sentence, the second question ask about the sentence type, and the third question requires to change the sentence type. The last example ask the student to complete the sentence by a demonstrative noun which require to select the demonstrative noun that agree in count and gender with the present noun.

V. STUDENT MODELING TECHNIQUE

We adopt CBM in modeling of the student knowledge. The CBM is represented by a set of constraints; each constraint represents a pedagogically significant state [17]. The basic definition of a constraint is formalized as

<Constraint-id> <relevance condition> < Satisfaction condition > <feedback action>

Where the relevant condition is the condition that represents situations where constraint applies, satisfaction condition is the condition that has to be true in order for the constraint to be satisfied, feedback actions is the action associated with the violation of the constraint.

Constraint-based modeling has many benefits such as decreasing the time required to build an ITS by providing detailed and specific feedback associated with the constraints. The incorrect answers are implicitly implemented in the constraints, so no need to implement them in the domain model in form of buggy-rules like model tracing [18]. In addition,

changing any constraint in CBM has no effect on the other constraints at all.

For modeling the student knowledge or skill in the linguistic domain, we modified the constraint form to be as following:

<Constraint-id> <Skill> <domain concept> < Satisfaction condition > <Positive feedback message> <Negative feedback message>

We replace the relevance condition by the skill and domain concept fields to categorize the constraints according to the different skill and concepts and facilitate the testing of relevance condition. Moreover, we augment positive feedback to encourage the student in the case of correct answer by a suitable feedback. It is worth to mention that, each question is defined by the skills it need to solve in addition to concepts it covers.

Example of different constraints for different skills are elaborated in the next sections.

A. Examples of identifying features skill constraints

Example 1: constraint for skill “Identify sub-category” and concept “demonstrative names”.

<1> <identify sub-category> <demonstrative names> <the student answer is one of demonstrative names> <Correct demonstrative name> <the choice is not demonstrative name>

<1> <تعريف على حسب النوع الفرعي> <أسماء الإشارة> <ال اختيار هو أحد أسماء الإشارة> <اسم إشارة صحيح> <"ال اختيار" ليس اسم إشارة>

Example 2: constraint for skill “Identify sub-category” and concept “1st person pronoun”.

<2> <identify sub-category> <1st person pronoun > <the student answer is one of 1st person pronoun> <Correct 1st person pronoun> <the choice is not 1st person pronoun >

<2> <تعريف على حسب النوع الفرعي> <ضمير المتكلم> <ال اختيار هو أحد ضمائر المتكلم> <ضمير المتكلم صحيح> <"ال اختيار" ليس ضمير متكلماً >

B. Examples of morphological skills constraints

If the question ask the student to convert from single to female dual. Checking of the student answer will converted to two identifying skill constraints, one for gender and the second for dual as following:

<6> <identify gender> <female > <the student answer is female> <Correct female > <the choice is not female>

<6> <تعريف على حسب الجنس> <مؤنث> <ال اختيار مؤنث> <ال اختيار مذكر> <"ال اختيار" ليس مؤنث>

<7> <identify number> <dual > <the student answer is dual> <Correct dual > <the choice is not dual>

<7> <تعريف على حسب العدد> <مثنى > <ال اختيار مثنى > <مثنى صحيح> <"ال اختيار" ليس مثنى>

It is worth mentioning that, the feedback message is aggregation of the two feedbacks with linked words according to their types. For example, if the student violated the two constraints the feedback will be aggregated using and such as “the choice is not female and not dual”. On the other hand if one of the two constraint is violated and the second is satisfied the linked word will be but such as “the choice is female but not dual”.

C. Examples of syntactic skill constraints

Agreement is one of skills that needed in constructing sentence. We give an example of agreement of demonstrative nouns – pointed out nouns. The agreement constraint consists of two constraints, one to check equality in gender and the second to check equality in number.

<18> < Agreement> < demonstrative nouns – pointed out nouns >

<18a> < check gender equality > < demonstrative nouns – pointed out nouns > <the gender of demonstrative noun equal gender of referred to name > < agreement in gender > < disagreement in gender>

<18b> < check count equality > < demonstrative nouns – pointed out nouns > <the count of demonstrative noun equal count of referred to name > < agreement in count > < disagreement in count >

<18> <تطابق إسم الاشارة مع المشار إليه> <تطابق إسم الاشارة مع المشار إليه في الجنس> <تطابق جنس إسم الاشارة مع جنس المشار إليه> <المشار والمشار إليه متافقين في الجنس> <المشار والمشار إليه غير متافقين في الجنس>

<18b> <تطابق إسم الاشارة مع المشار إليه> <تطابق إسم الاشارة مع المشار إليه في العدد> <تطابق عدد إسم الاشارة مع عدد المشار إليه> <المشار والمشار إليه متافقين في العدد> <المشار والمشار إليه غير متافقين في العدد>

VI. CONCLUSION AND FUTURE WORK

The paper presents a user modeling technique to model the student skills in Arabic language. The proposed model is based on constraint based modeling technique with some modifications. Different Arabic language skill (feature, morphology and syntactic skills) are considered in definition of the domain and in modeling process. In addition the skills are sorted according to their difficulties. Each system question is defined by the required skill(s) to solve and the related concept(s) it cover. Such definitions are used as a relevance condition in the defined constraints. Modeling of the student skills is proceeds by testing the student answer against the satisfaction condition in relevant(s) constraints. Student model is description of satisfied and violated constraints which is used in supporting the student with adequate feedback. In addition, the student model can be used in adaptive selection of the presented questions.

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Parallelizing the Berlekamp-Massey Algorithm

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Abstract—A linear feedback shift register has the property that its input bit is a linear function of its current state. It has many applications, such as cryptography and digital signal processing. The Berlekamp-Massey algorithm finds a shortest linear feedback shift register that generates the input binary sequence. If the length of the input is n , the algorithm takes $O(n^2)$ time. Various issues in serial implementation as well as parallel implementation of the algorithm are studied. A well-designed serial code can be up to 37.8 times faster than a typical implementation, and a CUDA implementation can deliver additionally 12.7 times speedup.

Keywords-component; *Berlekamp-Massey algorithm, linear feedback shift register, parallel computing, graphics processing unit formatting*.

I. INTRODUCTION

A linear feedback shift register (LFSR) has the property that its input bit is a linear function of the bits in its flip-flops (FFs). The length of an LFSR is its number of FFs. LFSRs have a simple and regular structure, and thus can be easily incorporated in digital circuits. They can be used to generate exhaustive binary sequences for the purpose of circuit testing, or they can be used as pseudo-random number generators. Applications of LFSRs include cryptography (GSM cell phone, Bluetooth) and signal scrambling (PCI Express, SATA, Gigabit Ethernet). In 1967, Berlekamp [2, 3] designed an algorithm to decode Bose-Chaudhuri-Hocquenghem codes; Massey [8] recognized its relationship to LFSRs and described a simplified version of the algorithm. From an input binary sequence, the Berlekamp-Massey algorithm (BMA) finds a shortest LFSR that generates the prescribed sequence. If the length of the binary sequence is n , BMA takes $O(n^2)$ time. Graphics processing units (GPUs) were originally designed for 3D graphics applications. These devices have become massively parallel co-processors to the CPUs.

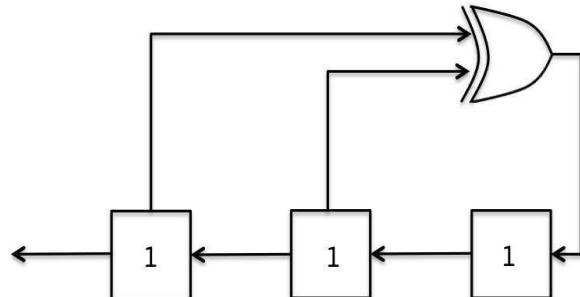


Figure 1: An LFSR with the primitive characteristic polynomial $x^3 + x^2 + 1$. Its periodic output sequence is 1110010 ... with period seven.

There is a research community devoted to general-purpose computing on GPUs. As of November, 2013, four of the top ten supercomputers in the world attain their computing capabilities mainly through the GPUs. Nvidia, AMD/ATI, and Intel are the three major vendors of these devices. In particular, Nvidia supports a C-like programming language called Compute Unified Device Architecture (CUDA) for programming their devices. The present work focuses on fast serial and parallel implementations of BMA.

Section 2 gives descriptions of LFSR and BMA. Section 3 presents considerations in fast implementation of BMA using CPU. Section 4 offers brief overviews of GPU and CUDA. Section 5 describes parallel implementation of BMA with CUDA. Section 6 has discussion and future work. The main results are the followings. First, a well-designed C code of BMA can be at least 37.8 times faster than typical implementations that can be found in the literature and on webpages. Second, a CUDA implementation can be 12.7 times faster than the well-designed C code.

II. LFSR AND BMA

If an LFSR has n flip-flops (FF), it can be represented by a polynomial of degree n in the binary field, which is called its characteristic polynomial. For example, the LFSR in Figure 1 is represented by $x^3 + x^2 + 1$. The coefficient for the x term is 0 because the first FF on the right is not tapped for feedback, while the coefficients for the x^2 and x^3 terms are 1's because the second and third FFs are tapped for feedback; addition in the binary field is equivalent to the logical exclusive-or. The

bits in the FFs constitute the state of the LFSR. The state with all 0's is a locked state, because the LFSR will be stuck in it. When seeded with any other state, an LFSR generates a periodic sequence; the sequence will repeat itself because the number of states of an LFSR is finite. If the LFSR in Figure 1 is seeded with the state 111, the output sequence is 1110010 · · · of period seven, corresponding to repeating the seven states 111, 110, 100, 001, 010, 101, and 011. If an LFSR generates a sequence with the maximum period, $2^n - 1$, its characteristic polynomial is called a primitive polynomial. The maximum-period output sequence appears pseudo-random. There are $2n-1$ runs of contiguous ones and zeros in the periodic sequence; half of the runs are of length one (the sixth and seventh bits of 1110010), a quarter of them are of length two (the fourth and fifth bits of 1110010), one eighth of them are of length three, and so on, and finally one run of length n (the first three bits of 1110010). The frequencies and lengths of these runs match their expected values in random sequences. Some primitive polynomials of large degrees are known [9].

```

1 B[0] = C[0] = 1;
2 for(i=1; i<lengthS; i++) B[i] = C[i] = 0;
3 lengthC = 0;
4 m = -1;
5 for(N=0; N<lengthS; N++){
6     d = 0;
7     for(i=0; i<=lengthC; i++) d ^= C[i] & S[N-i];
8     if (d){
9         for(i=0; i<=lengthC; i++) tmp[i] = C[i];
10        for (i=0; i<lengthS-N+m; i++) C[N-m+i] ^= B[i];
11        if (lengthC <= N>>1){
12            for(i=0; i<=lengthC; i++) B[i] = tmp[i];
13            lengthC = N+1-lengthC;
14            m = N;
15        }
16    }
17 }
```

Figure 2: C code for BMA. The pointers S, B, C, and tmp are integer arrays of length lengthS. S holds the input bit sequence. When the outer loop, from Line 5 and to Line 17, finishes, the degree of the characteristic polynomial is lengthC, and the coefficients of the polynomial are in the array C. Clearly, BMA is concise, but the insight that it works is not obvious. In fact, more than twenty years after the BMA papers, Henkel wrote an article [6] to help a new generation of people understand BMA. There are more than 1,600 citations of

BMA [2, 3, 8] finds a shortest LFSR that will generate the input binary sequence; there may be more than one shortest LFSR. In [8], Massey described an inductive proof of the lower bound of the length, and provided a construction of an LFSR that matches the lower bound. Figure 2 shows a C-language implementation of the pseudocode in [8] for the LFSR construction. The pointers S, B, C, and tmp are integer arrays of length lengthS. S holds the input bit sequence. All the other variables are integers. When the outer loop, from Line 5 to Line 17, finishes, the degree of the characteristic polynomial is lengthC, and the coefficients of the polynomial are in the array C. Clearly, BMA is concise, but the insight that it works is not obvious. In fact, more than twenty years after the BMA papers, Henkel wrote an article [6] to help a new generation of people understand BMA. There are more than 1,600 citations of

Massey's paper. It is beyond the scope of the present work to explain it.

The original pseudo code used addition and multiplication. Because these operations are performed in the binary field, they are replaced by the logical exclusive-or (^) and "and" (&) operators, respectively. On almost all hardware platforms, the logical operations are no slower than arithmetic operations, and on some platforms, the logical operations would be faster. Let n be the length of the input sequence, and let k be the length of a shortest LFSR that generates the input. The outer loop, from Line 5 to Line 17, will be executed n times. During each iteration of the outer loop, the inner loops on Lines 7, 9, and 12 will be executed $O(k)$ times, and the loop on Line 10 will be executed $O(n)$ times. Thus the C code takes $O(kn + n^2) = O(n^2)$ time. Variants of the code in Figure 2 can be found in many publications and web pages, and some of them have replaced the arithmetic operations with the logical operations. Yet the C code and its time complexity can be easily improved. The array B holds the previous value of the array C. Since the length of C is stored in lengthC all the time, the length of the previous C may be saved in a variable, lengthB, before the previous lengthC is overwritten by the latest lengthC; that is,

lengthB = lengthC;

may be inserted between Lines 12 and 13. With this additional statement, the loop on Line 10 may be modified to make no more than lengthB iterations; the extra iterations that are now skipped would be performing exclusive-or when one of the operands, B[i], is zero. With this modification, the time complexity for the loop on Line 10 is reduced from $O(n)$ to $O(k)$, and the total time complexity for the C code in Figure 2 is reduced from $O(n^2)$ to $O(kn)$.

III. FAST SERIAL IMPLEMENTATION OF BMA

Let us first improve the performance of the serial implementation of BMA. All variables and lines of code in the present section are made in reference to Figure 2. As shown in Figure 3, the loop on Line 7 reads the array S in the reversed direction, which goes against the grain of cache lines and cache prefetch of memory management in modern computers.

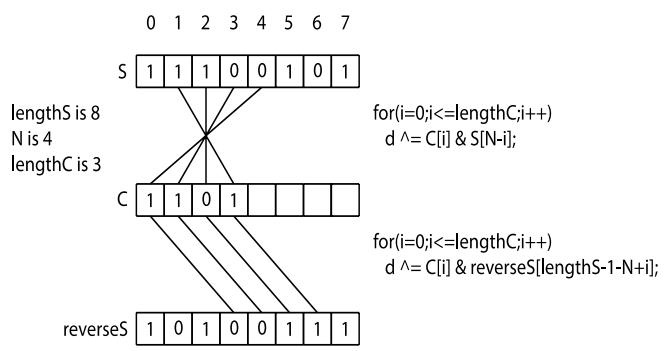


Figure 3: The loop on Line 7 in Figure 2 will access the array S in reverse. By reversing S such as in reverseS and changing Line 7 accordingly, the access pattern fits the cache memory management better.

If the input sequence S is reversed as in the array reverseS, and if Line 7 is modified accordingly as shown in Figure 3, the access pattern will flow better with either compiler-generated or hardware-issued cache prefetches. The execution times of the original code and the modified code that uses the reversed sequence are compared. The computer hardware is described in Section 4. The C code is compiled with the gcc compiler and the optimization flag -O3. The results are shown in Table 1, where the first double-column is for the original C code, and the second double-column is for the C code using the reversed sequence. Three pseudorandom sequences for each length n are generated. The numbers under the heading “time” are the average run time in seconds. The numbers under the heading “ratio” are the run time of length 2n divided by that of length n. From the data in Table 1, one can see that the original C code takes three to five percent more time than the code using the reversed sequence, supporting the observation made in Figure 3. From here onwards, all code uses only the reversed sequence for computation.

When the input is a random sequence, the length, k, of the resulting LFSR is very close to $n/2$ [10]. Thus the run time of BMA is quadratic in n for random sequences, as evidenced by the ratios of 4 or so when n is doubled. The pseudorandom numbers used in the present work are generated by the function erand48() of glibc, which uses a linear congruential formula to calculate the numbers. As a side note, the function rand() in glibc actually uses an LFSR to generate its numbers. If rand() is used instead of erand48(), any implementation of BMA would find the characteristic polynomial of the LFSR of rand() in a blink of an eye. From then on, the rest of the computation is simply verifying that the polynomial indeed generates the sequence. The run time of BMA is reduced to linear in n when k is a constant.

The data in the arrays S, B, and C are bits. It is wasteful to use a 32-bit integer to store just one bit. More importantly, when 32 bits are packed into one unsigned int, the numbers of iterations of the loops on Lines 7, 9, 10, and 12 will be reduced by a factor of 32 (although the number of iterations of the outer loop, from Line 5 to Line 17, does not change). This may bring about 32-fold speedup. To initialize for bitwise computation, the bits of the reversed S are packed into an unsigned integer array bitS, which has length $\lceil n/32 \rceil$. bitC and bitD are similarly defined, and the most significant bit of bitC[0] and bitD[0] are set to 1 (Line 1); that is, bitC[0] and bitD[0] are set to 231. Most parts of the code, such as the bitwise operators of C, remain the same. However, the loops on Lines 7 and 10 present complications. For the loop on Line 7, the array bitC are always accessed from the most significant bit of bitC[0] onwards. However, with each successive iteration of the outer loop, the frame of bitS to be matched to bitC is shifted to the left by one bit. There are two ways to solve this problem:

- a. If the bits of bitS to be matched to bitC[i] are split between bitS[N-i] and bitS [N-i+1], bit shift operators

and bit masks can be used to extract the lower bits from bitS[N-i] and the upper bits from bitS[N-i+1].

Table 1: Experimental results of four implementations of BMA are compared.

n	CPU		non-CPU		bitwise CPU		bitwise	
	time	Ratio	time	ratio	Time	ratio	Time	ratio
1024	0.00269		0.00271		0.000151		0.0406	
2048	0.00268	0.99	0.00257	0.95	0.000466	3.09	0.0806	1.99
4096	0.0105	3.92	0.0120	4.68	0.00154	3.31	0.162	2.01
8192	0.0435	4.15	0.0419	3.48	0.00558	3.62	0.323	2.00
214	0.167	3.90	0.168	4.01	0.00806	1.44	0.645	2.00
215	0.688	4.06	0.654	3.88	0.0195	2.42	1.30	2.01
216	2.76	4.01	2.60	3.98	0.0749	3.84	2.61	2.01
217	11.2	4.05	10.6	4.07	0.291	3.89	5.19	1.99
218	45.8	4.11	43.6	4.12	1.17	4.03	10.5	2.02
219	192	4.19	186	4.27	4.70	4.01	21.0	2.01
220	802	4.17	772	4.15	18.7	3.98	43.0	2.04
221					75.3	4.03	87.6	2.04
222					320	4.25	184	2.10
223					1333	4.17	412	2.24
224					5434	4.08	1016	2.47
225							2757	2.71
226							8364	3.03
227							28475	3.40
228							109206	3.84

The four implementations are: the C code in Figure 2, the C code with the input reversed as in Figure 3, C code with bitwise operations, and CUDA code with bitwise operations. Three pseudorandom bit strings of each length n are generated. The numbers under the heading “time” are the average run time in seconds. The numbers under the heading “ratio” are the run time of length 2n divided by that of length n.

These extracted bits are put together into a 32-bit word, which is then matched to bitC[i].

- b. Instead of extracting bits from two consecutive words and putting them together time and again, 32 bitwise-staggered copies of bitS are made that correspond to all 32 access frames. Then the value of N is used to choose the proper frame of bitS to be matched to bitC.

For the loop in Line 7, the second solution is employed, because the 32 copies of bitS can be prepared only once, during initialization, and they are used repeatedly. For the loop on Line 10, it is bitC that shifts its frames, and thus the first solution is employed. The reason is that bitC not only shifts its frames, but also changes its values. Even if 32 frames of bitC are created, only one of them will be used in the next iteration, and then 32 frames for the latest bitC need to be made again. One last complication remains. The variable d used to hold just one bit, so its value is either one or zero on Line 8. With bitwise operations, d ends up holding 32 bit values, and the condition on Line 8 needs to test whether the exclusive-or of these 32 bits is one or zero. The operation of counting the one

bits in a word is also known as sideways addition. The best method for counting bits in a 32-bit word takes 12 operations [1] as shown in Figure 4.

```
d = d - ((d >> 1) & 0x55555555);
d = (d & 0x33333333) + ((d >> 2) & 0x33333333);
d = (((d + (d >> 4)) & 0xFOFOFOF) * 0x1010101) >> 24;
```

Figure 4: Let d be a 32-bit unsigned integer. The C code performs sideways addition, that is, counting the number of one bits, in d with 12 operations [1].

The third double-column of Table 1 shows the results of the bitwise CPU code. It is significantly faster than the code that uses one integer for one bit. At the input length of 220, bitwise CPU code takes 18.7 seconds, which is 41 times faster than 772 seconds of the code that uses one integer for one bit. In theory, 32-fold speedup should be the upper bound, and thus the bitwise CPU code achieves superlinear speedup. One explanation is the following: By packing the arrays C and D into bitC and bitD, the memory that they take is reduced to one thirty-second, which increases the cache hit ratio and reduces the overall memory access latency [4]. Notice that although the array S is packed into bitS, 32 copies of staggered frames of bitS are made. Thus there is no overall space saving with respect to S.

It is reasonable to project that the “CPU non-reverse” time will continue to quadruple beyond 220 bits. If that is the case, it is expected to take 802×44 seconds for 224 bits, which would be 37.8 times the “bitwise CPU” time, 5,434 seconds. Section 6 discusses additional techniques that may further speed up the execution by the CPU.

IV. CUDA, GPU, AND HARDWARE SETUP

Nvidia has released several generations of CUDA-capable GPU devices. The parallel computation conducted in the present work is performed with Tesla M2090. It has 16 streaming multiprocessors (SMP) with 32 cores in each SMP, for a total of 512 cores. There are 6GB of RAM. The server that hosts the M2090 device is a Linux (CentOS) machine with one 3.4 GHz AMD Phenom II X4 965 processor, 16 GB RAM, and a 120GB solid state boot drive. All computation to be described herein is conducted on this server. When the computation is performed with the CPU, only one of the quadcores is used. When the computation is performed with the GPU, again only one of the CPU cores interacts with the GPU. Nvidia has a programming guide to CUDA [7], which is an extension of C. Briefly, the Single Program Multiple Data (SPMD) code is written in a GPU kernel function, which contains the code that will be executed by the GPU cores. CUDA supports a large number of threads. The threads are organized into blocks, and the blocks are further organized into a grid. A block can be one-, two-, or three-dimensional, and it may contain up to 1,024 threads. A grid can be one-, two-, or three-dimensional with up to $(216 - 1)$ blocks in each

dimension. Thus a kernel may be invoked with up to $(216 - 1) \times (216 - 1) \times (216 - 1) \times 1024$ threads in one execution configuration. Each block of threads is executed on an SMP. The threads within a block are dispatched to the processors in groups of 32, called a warp. A limitation is that all cores in one SMP must execute the same instruction or a “No Operation.” When there is an if statement, and when some threads within a warp follow the if branch while the other threads follow the else branch, the execution of the two branches are serialized. This divergent execution slows down the computation. The GPU device provides registers and local memory for each thread, a shared memory for each block, and a global memory for the entire grid of blocks of threads. Although all threads execute the same GPU kernel function, a thread is aware of its own identity through its block and thread indices, and thus a thread can be assigned a specific portion of the data on which it can perform computation. The shared memory for a block of threads is fast, yet it is limited in size. One strategy to attain high performance is for the threads in the same block to collaborate on loading data that they all need from the global memory to the shared memory.

V. GPU-PARALLELIZATION OF BMA

After some preliminary studies, it was found that CUDA implementation of BMA would not be able to compete with the CPU bitwise implementation when the input sequence was short, because on the one hand the CPU bitwise code is very efficient, and on the other hand there is overhead involved in executing even a very simple kernel function on the GPU. Thus the considerations described hereafter are geared towards solving a long input sequence, such as 220 (1M) bits or longer. The skeleton of the CUDA code is similar to the C code in Figure 2. All 32 bitwise-staggered frames of the array bitS, and arrays bitC, bitB, and bitTmp are initialized in the CPU RAM, and then copied to the GPU RAM using the function cudaMemcpy() provided by the CUDA API. The control of the loop from Line 5 to Line 17 is executed by the CPU. The inner loops on Lines 9 and 12 are simple memory copy operations, and they are translated to CUDA code using the function cudaMemcpy(). The loop on Line 7 is more involved. First, one of the 32 frames of bitS is chosen that has the proper alignment with the array C. This frame of bitS and the array C are passed to a CUDA kernel function. This kernel function is a classical example of reduction [5]. It first performs the bitwise logical “and” between bitS and bitC with 256 threads in one block and 64 blocks in the grid in the execution configuration, where each block of threads uses 1,024 bytes of shared memory. These parameters are chosen by using the CUDA Occupancy Calculator in such a way that the 512 processing cores in M2090 are utilized as much as possible. The bitwise exclusive-or for the variable d is performed by the highly optimized reduction CUDA code released by Nvidia [5]. Because there are 64 blocks of threads when the first kernel is invoked, there are 64 partial results of d. Thus a second reduction kernel is invoked to reduce these 64 32-bit words to one 32-bit word, which is then copied from GPU RAM to CPU RAM. Finally,

the 12 operations of the sideways addition in Figure 4 are performed on the 32-bit word by the CPU.

The bitwise version of the loop on Line 10 of Figure 2 involves shifting frames of bitC. Because the values in bitC will be overwritten repeatedly, rather than making 32 bitwise-staggered copies, bitC will be used directly. In fact, because the GPU has more computing power than memory bandwidth, the overall computation will be faster if only one copy of bitC is kept and the multitude of processing cores are used to shift the frames of bitC in their registers.

Let n be the length of the input sequence, and let k be the length of a shortest LFSR. The fourth double-column of Table 1 shows the results of bitwise GPU code. When n is small (220 or 1M bits or fewer), the bitwise CPU code (the third double-column) is definitely faster than the GPU. When n is larger than 2M, the GPU surpasses the CPU. As discussed earlier, the time complexity of BMA is $O(kn)$, and because pseudorandom sequences are used in the computations, k is close to $n/2$ [10]. When n is doubled, it is expected that the computation time will be quadrupled. All three versions of CPU code have demonstrated this behavior. In fact, the lower the performance, the earlier the onset of the quadruple of computing time. However, this quadrupling pattern is not completely set in for the GPU code even for input of 228 (one-quarter of 1G bits). As a crude approximation, the computation time may be expressed as $C_2 n^2 + C_1 n$. The quadratic part comes from computing, and because the GPU has 512 cores, the constant C_2 is relatively small for GPU. The linear part comes from the launch of kernel functions and their barrier synchronization, and thus C_1 is relatively large for GPU. In the last column of Table 1, for n from 1,024 to about 4M bits, the total time is dominated by the linear term so that the ratios are in the neighborhood of two. When n becomes larger and larger, the quadratic term gradually catches up and starts to dominate the total time.

It is reasonable to project that the bitwise CPU time will continue to quadruple beyond 225 bits. If that is the case, it is expected to take 5434×44 seconds for 228 bits, which would be 12.7 times the GPU time, 109,206 seconds. However, this 12.7 times speedup is likely to be the best that the GPU can achieve, because the GPU time will start to quadruple probably at 229 bits. As both methods quadruple their times, their ratio remains in the neighborhood of 12.7.

VI. CONCLUSIONS

The bitwise CPU code is faster than the GPU code for input up to 220 or 1M bits (Table 1). Specifically, the CPU code takes 18.7 and 75.3 seconds for 1M and 2M bits, respectively. Put it another way, the CPU uses 18.7 seconds for the first 1M bits and 56.6 seconds for the second 1M bits. However, the GPU needs 43 seconds for the first 1M bits and 44.6 seconds for the second 1M bits. Thus the GPU is already faster than the CPU for the second 1M bits. This observation leads to a hybrid approach: If the input is 2M bits or longer, we can use the CPU code for the first 1M bits, and then we can switch to the GPU code for the remaining input bits. This

hybrid code will save the time difference between CPU and GPU for the first 1M bits, that is, about 24 seconds. The hybrid code is implemented and tested, but the results are not shown in Table 1. The hybrid code indeed delivers a saving of 24 seconds from 2M bits onwards, although the saving soon becomes irrelevant when the total time exceeds 1,000 seconds. Although the bitwise CPU code is presented in the section on fast serial implementation, the technique is a form of parallel computation. The logical operations perform the same computation for all 32 bits in a word independently and in parallel. This approach has already been taken to a higher level. Some Intel and AMD processors support a Single Instruction Multiple Data (SIMD) instruction set called Streaming SIMD Extensions (SSE). SSE uses a number of 128-bit registers, and provides special machine instructions that operate on them. For example, there are instructions to perform the bitwise logical operations on all 128 bits simultaneously. The Advanced Vector Extensions use 256-bit registers, and a 512-bit version has been proposed. It is likely that by using these wide registers/instructions, the bitwise SIMD CPU code may outperform the bitwise GPU code. This is left as future work.

Some Nvidia GPUs (Compute Capability 2.0 or higher) allow concurrent kernel execution, where many instances of the CUDA BMA code can be executed on different input sequences concurrently on the same GPU device. This mechanism may offer a way to extract more computation out of the device. We are working on this aspect of parallel computation for BMA.

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Improvement of Energy Efficiency by Using Smart Antenna System of BTS Application

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Abstract— This paper presents a smart antenna system for BTS application. The proposed antenna is an antenna array, composed from three dipoles spatially separated antennas, and it's able to estimate the direction of arrival (DOA), directing the radiation pattern towards the desired user to allow significant energy saving. This article discusses advantages of this system for base transceiver station highlights improvements that are possible by using different delay lines. The comparison between measurement results and simulation results are provided to validate the model.

Keywords-component; smart antenna, radiation pattern, gain, power density, energy efficiency, antenna array, delay line, DOA

I. INTRODUCTION

Global System for Mobile Communication (GSM) is currently one of the most widely and most demanding telecommunication applications in the world. In the GSM network, the antennas of Base Transceiver Station (BTS) are characterized by a fixed radiation pattern covering the entire sector, but if the BTS emit towards a single subscriber, this information is radiated everywhere on the sector covered [1]. Human is surrounded by RF field, via GSM, BTS, WIFI, and in literature, the studies showed that radiation from BTS may be dangerous to public health [2-6]. The new evolutions require to improve this antennas BTS which became insufficient. The objective of this paper is to present a solution based on smart antenna often called antenna array, which will optimize the radiation pattern of the base station by making it more directive. This can help to minimize the radiated energy and therefore will allow the operator to decrease its transmission power while covering the entire sector.

The paper is structured as follows: in Section II, we focus the description of smart antennas. In Section III, both working principle operating mode and design of the proposed antenna are described. In section IV, the comparison between measurement and simulation results are shown and discussed. In section V, we study the energy efficiency brought by a smart antenna.

II. SMART ANTENNA

The Smart Antenna generally refers to any antenna array, terminated in a sophisticated signal processor, which can adjust or adapt its own beam pattern in order to emphasize signal processor, which can adjust or adapt its own beam pattern in

order to emphasize signals or interfering signals [7]. Smart implies the use of signal processing in order to shape the beam pattern according to some conditions. The two main types of smart antennas include switched beam and adaptive array systems. Switched beam systems have several pre-determined fixed beam patterns. At any given point in time, a decision is made as to which beam to access. Adaptive arrays allow the antenna to guide the beam to any direction of interest while simultaneously making nulls in the direction of interfering signals [8].

Smart antennas have numerous important benefits in wireless applications as well as in sensors such as radar. In the realm of mobile wireless applications, smart antennas can provide higher system capacities by directing narrow beams toward the users of interest, while nulling other users not of interest Fig.1. This allows for higher signal-to-interference ratios, lower power levels, and permits greater frequency reuse within the same cell. This technique is called space division multiple access (SDMA) [9].

The smart antenna technology is based on antenna arrays where the Radiation pattern is changed by adjusting the amplitude and relative phase on the different elements of the array, the total electromagnetic field of the antenna is calculated by the sum of fields produced by each of the elements of array. Smart antennas are composed of a set of two or several elements. These elements can take any geometrical shape (Linear, Circular, planar) [10].

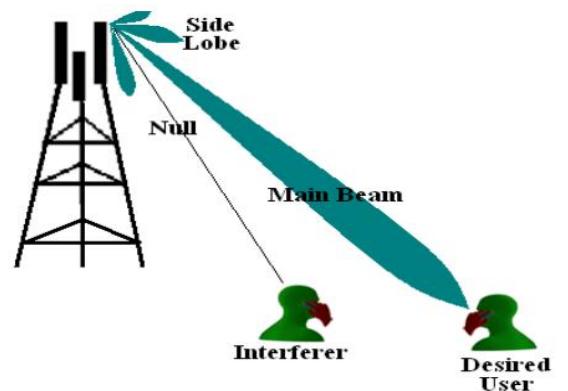


Figure 1. Main beam toward desired user and null toward interferer

In our case, we consider a linear array of N equispaced dipoles positioned along the x -axis as shown in Fig.2. These antennas are supplied with same current amplitude and with a gradient of phase φ_i .

For a point M situated in the zone of far radiation $|OM|$ all the directions of observation are parallel. The field radiated by this array $E(M)$ and the array factor $AF(\theta)$ can be obtained by considering the elements to be point source [10].

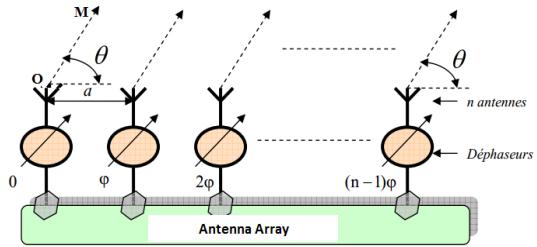


Figure 2. Representative Plan of a linear array

$$E(M) = \frac{j60\pi}{\lambda} \frac{e^{jK|OM|}}{|OM|} \sum_{i=0}^{n-1} A_i e^{j(\psi_i)} \quad (1)$$

$$AF(\theta) = \sum_{i=0}^{n-1} A_i e^{j(i(\frac{2\pi d}{\lambda} \cos \theta + \varphi_i))} \quad (2)$$

Where $\varphi_i \in [\varphi_0, \varphi_1, \dots, \varphi_{N-1}]$ represents the phase excitation of the n^{th} element (the antenna in the beginning is taken as phase reference: φ_0), d_i represents the position of the n^{th} element, $K = 2\pi/\lambda$ is the wave number, θ is the angle of incidence of desired signal or interfering signal, A_i is the amplitude of elements, and λ is the signal wavelength.

$$\text{With } A_i = A_0 \text{ and } \psi_i = \varphi_i + Kd_i \cos \theta \quad (3)$$

III. PROPOSED APPROACH

The geometrical structure of the proposed antenna is shown in Fig.3. We chose a GSM frequency of the order of 900 MHz. The realized antenna is constituted by a linear array, which contains three half-wave elementary antennas dipoles. We used a delay lines to create the phase shift between the dipoles of antenna whose length is calculated from "(4)". To make the measures of the antenna array, and to observe and validate the concept of the smart antenna we used three various delay lines which correspond to three various phase shifts Table. I.

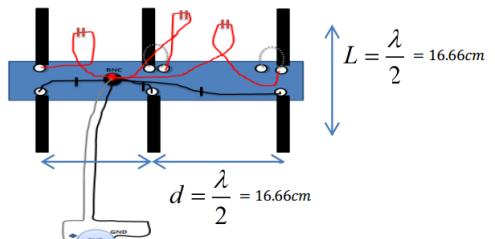


Figure 3. Proposed Antenna

Delay line allows changing the phase shift between the three dipoles. We demonstrated that for a given direction, we could calculate the necessary phase shift to have a radiation pattern with a main lobe directed to this direction. The spacing between elements is a very important factor, because it acts on the constructive and destructive interferences in the far fields of the antenna, and consequently on the total radiation pattern. We separate the elements from each other by half-wavelength because it is appropriate for the most part of the applications of the linear array. In this case, we reduced significantly the side lobes and consequently the interferences. Fig.4 shows the impact of spacing of elements on reducing the side lobes.

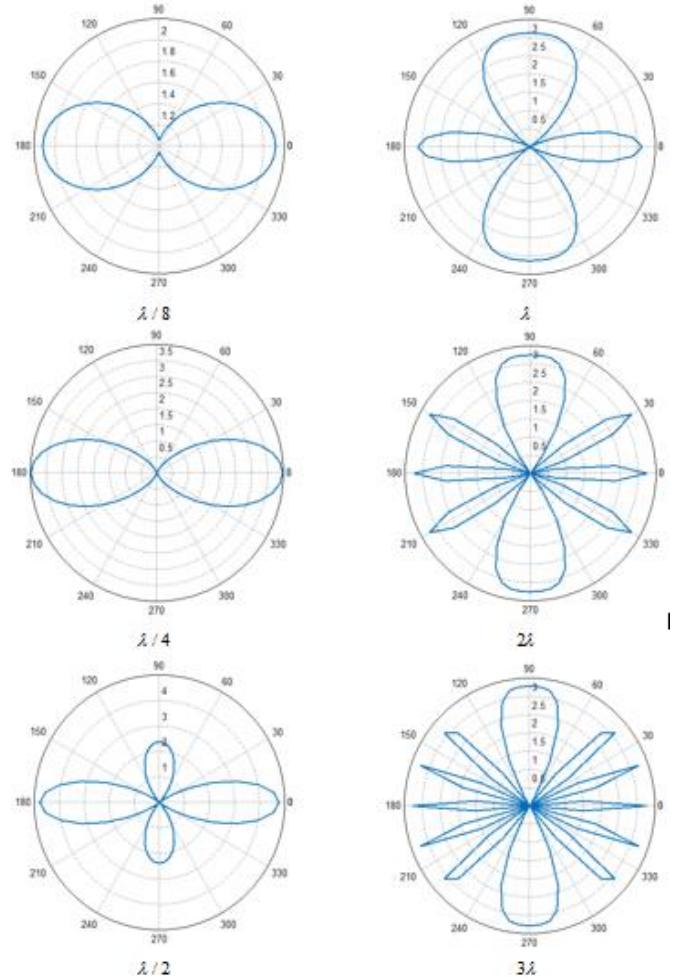


Figure 4. Impact of spacing of elements on reducing the side lobes.

Fig.4 shows a radiation pattern of a two elements dipoles of an antenna array separated from each other by a distance varied between $\lambda/8$ and λ . The objective of this study is to optimize the separation distance between the two elements of antenna array. The distance $\lambda/2$ offers an optimal radiation with two main lobes in two symmetrical directions without side lobes. This distance also allows having an optimum gain.

The formula of command of phase is given as follow:

$$\psi = \varphi + Kd \cos \theta = 0$$

$$\lambda \rightarrow 2\pi$$

We have

$$\varphi \rightarrow \Delta l$$

$$\Rightarrow \Delta l = \frac{\varphi \lambda}{2\pi} \quad (4)$$

With Δl the length of the delay line

TABLE I. THE LENGTH OF THE DELAY LINES DEPENDING ON DIRECTION

Delay line length (cm) Δl	Phase shift (deg)	Direction (deg)
11.11	120	48.70
14	151.21	32.85
16.66	180	0

Depending of the length of delay line, the lobe will be toward the desired direction Table. I.

IV. MEASUREMENT RESULTS

In this part, we measured the radiation pattern of our antenna, the results are compared with those obtained by simulation.

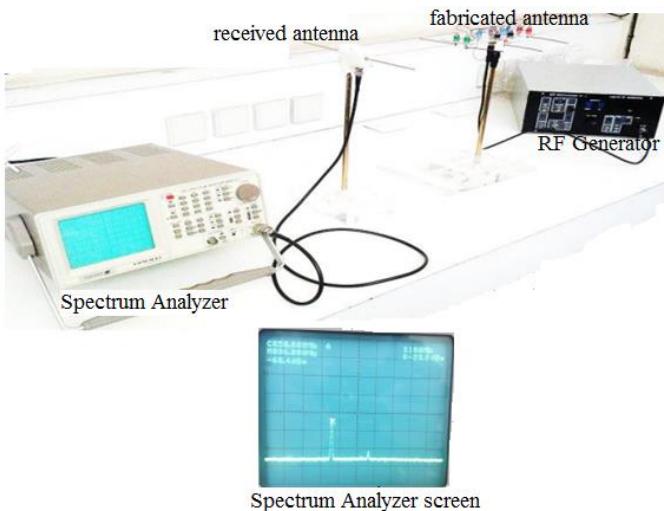


Figure 5. Measurement Setup.

The antenna is connected to RF (Radio Frequency) generator. To get the field attenuation, we used a half wave dipole connected to the spectrum analyzer. We took up the maximum of the signal, which corresponds to the peak in order to find the value in dBm of the received field. We repeat this measurement 25 times for several direction from 0° to 360° with an increment of 15° .

The right part of Fig.6, Fig.7, and Fig.8 shows respectively measurement results of radiation pattern according to the direction of the antenna array with three half-wave dipoles with a delay line of 11,11cm, 14cm and 16,66cm. The left part presents simulation results of the array function for the three delay lines considered.

From figures, we can see that the radiation pattern of measurements and simulations has the same form. However, we observe some differences of gain values due to the experimental conditions.

Measurements were performed in an indoor environment. Therefore, there are a lot of multipath due to the presence of walls and others objects metallic devices. In addition, the used spectrum analyzer does not offer an accurate reading of the peak value, which increases uncertainty related to the measure. We can also see that a slight deviation of the main lobe relative to the simulation results, this gap explained by the uncertainty about the exact value of the angles that we have chosen for our measures. All the mentioned elements above justify the differences observed between measurements and simulations.

Although the observed differences of the gain values between measurements and simulations, the objective of this study, is to validate the directivity form of radiation pattern by using delay lines.

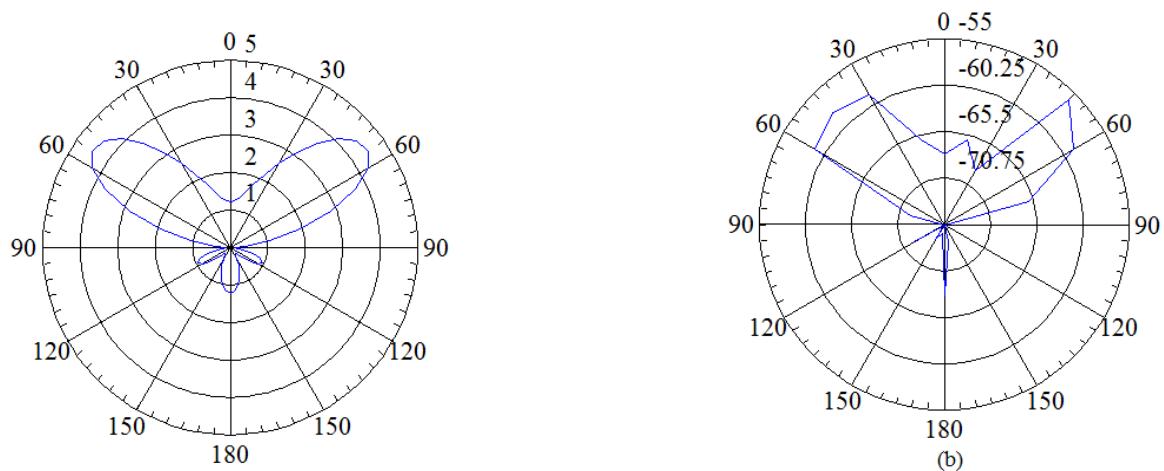


Figure 6. (a) Simulation Radiation Pattern with insertion of phase shift 120° , (b) Measurement Radiation Pattern with insertion of delay line of 11.11 cm.

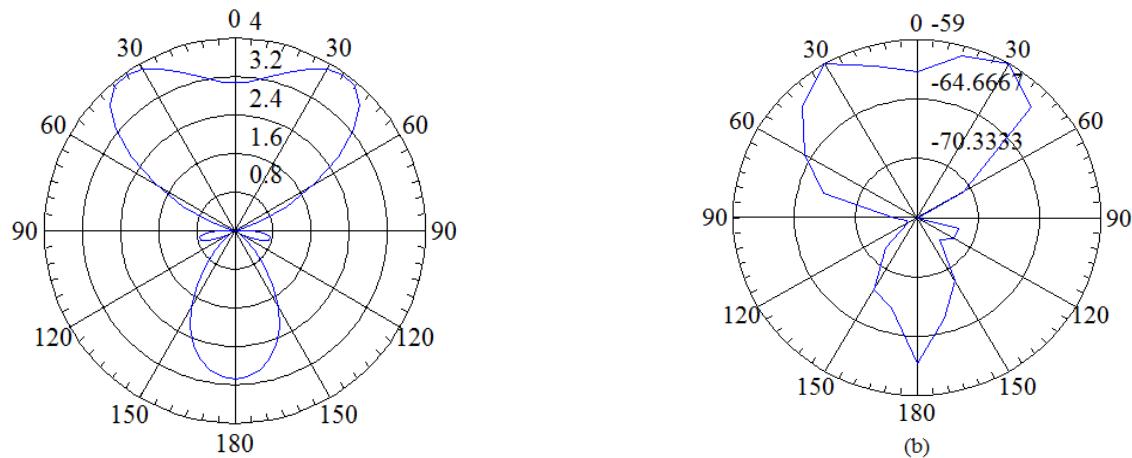


Figure 7. (a) Simulation Radiation Pattern with insertion of phase shift 151.21° , (b) Measurement Radiation Pattern with insertion of delay line of 14 cm.

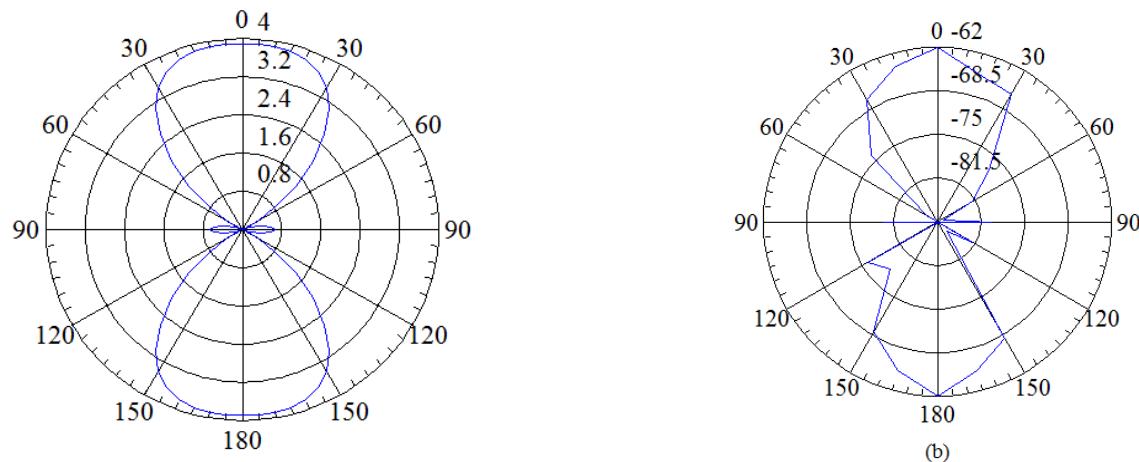


Figure 8. (a) Simulation Radiation Pattern with insertion of phase shift 180° , (b) Measurement Radiation Pattern with insertion of delay line of 16.66 cm

V. ENERGY EFFICIENCY

First, we studied the obtained gain with a smart antenna system in a given direction, and compared it with that of omnidirectional antenna

In this study, we took a given direction $\theta = 30^\circ$, and we study the gain obtained with a smart antenna system (SA) according to numbers of antenna elements, and compared it with that of an omnidirectional antenna. If we compare the ratio of power density of a smart antenna system with power density of a simple antenna dipole. We deduce that there is no loss and that the gain is equal to the directivity. The expression of the gain is given as follow [11-12]:

$$G(\theta) = 4 * \pi * \frac{AF^2(\theta)}{\iint_{\Omega} AF^2(\theta, \phi) d\Omega} \quad (5)$$

Where $d\Omega = \sin(\theta)d\theta d\phi$ the solid angle and AF is the array function.

In the hypothesis of far field, we assume that for the electric and magnetic fields we have the same phase difference. The expression of electromagnetic fields for a simple dipole is given as follow [11]:

$$\begin{aligned} \vec{E} &= \frac{-1}{r * c} * \left[\frac{\mu * I * \omega}{4 * \pi} \right] \sin(\theta) e^{j(\omega t - Kr)} \vec{e}_\theta \\ \vec{B} &= \frac{-1}{r * c} * \left[\frac{\mu * I * \omega}{4 * \pi} \right] \sin(\theta) e^{j(\omega t - Kr)} \vec{e}_\phi \end{aligned} \quad (6)$$

Where r is the distance to the far point, c is the celerity, μ is the permeability, I is the intensity of current, $\omega = 2\pi f$ is the pulsation, $K = 2\pi / \lambda$ is the wave number, λ is the wavelength and f is the frequency.

The power density is given as follows [6]:

$$\frac{dP}{dS} = \vec{E} \wedge \vec{B} \quad (7)$$

TABLE II. GAIN ACCORDING TO THE NUMBER OF DIPOLES

Number of dipoles	Gain $\theta = 30^\circ$
1	1,75
2	3,6
3	5,4
4	7,5
5	9
6	11,25
7	12,5
8	15

TABLE III. RATIO BETWEEN POWER DENSITY OF SMART ANTENNA AND POWER DENSITY OF SIMPLE ANTENNA DIPOLE

Number of dipoles	$(\frac{dP}{dS})_{SA} / (\frac{dP}{dS})_{1dipole}$; $\theta = 30^\circ$
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64

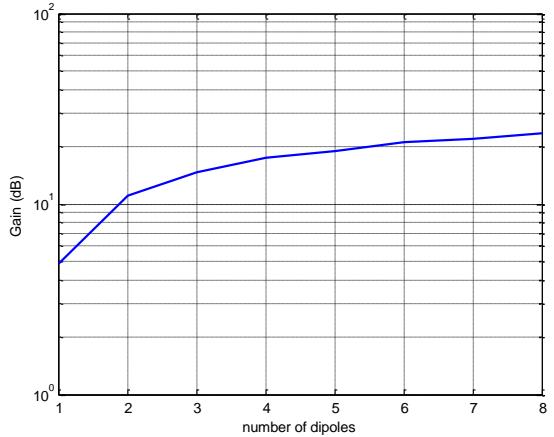


Figure 9. Evolution of the gain according to the number of dipoles

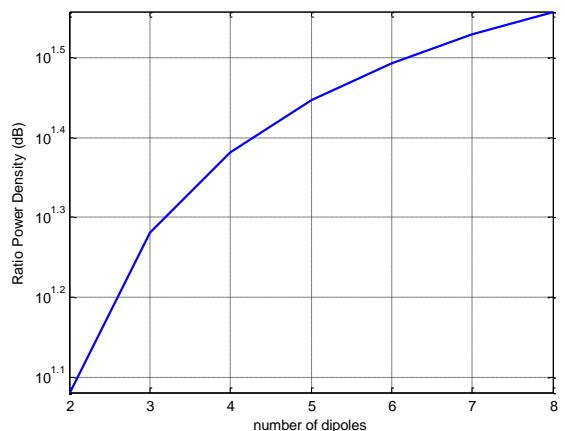


Figure 10. Evolution of the ratio between power density of a uniform linear antenna array and power density of one antenna dipole according to the number of dipoles

Fig.9 and Fig.10 shows the evolution of the energy efficiency by using smart antenna system, the results offer better performance of an array composed of several elements, we notice that respectively gain and energy improve and increase according to the number of dipoles.

VI. CONCLUSION

This paper proposes a smart antenna system particularly adapted for BTS applications. The linear radiating structure is composed of three identical elements of half-wave dipoles distant from a half-wave length distance for the radiation is important.

Measurements results obtained by the proposed smart antenna, offer a high gain and a significant energy efficiency.

The results show that, the radiation pattern changes according to the phase difference between antenna elements.

The comparison between measurements and simulations is in good agreement.

These measures can be improved, if they are done in an anechoic environment.

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Mathematical Analysis of the throughput using Fountain Code-Enabled DCF on IEEE802.11 based Wireless Sensor Networks

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Abstract—This paper presents a simple approximation mathematical model of fountain code-enabled distribution coordination function to calculate the throughput for the ideal condition of IEEE802.11 using the request to send/clear to send of four-way handshaking technique. This estimation introduces a new linear approximation model that reduces the complexity of the nonlinear of the analytical model. However, the resolution of non-linear system and performance modeling analysis of the IEEE 802.11 network in all its various extensions have been the subject of several studies. Because the analytical results for these non-linear models are difficult to verify and some equations are given without clear proof. This analysis is validate by comparison with simulation results using Matlab.

Keywords— Mathematical Analysis, Wireless Sensor Network, Fountain Code, Throughput, Markov Chain.

I. INTRODUCTION

We have focused in this paper to extend an existing and valid Markov chain model, in order to consider that all nodes have a packet to send. Therefore, we have developed mathematical models to compute the overall throughput and the mean response time of the IEEE 802.11 sensor network. In this context, the energy consumption is a critical resource that can be save by minimizing the number of transmissions to be perform in the network. From the network perspective, channel contention is a serious problem in WSNs resulting in collisions. The distribution Coordination Function (DCF) play an important role in analytical model for IEEE802.11in the MAC layer protocol. Our solution uses the Fountain code enabled DCF (FCE-DCF) under saturation traffic and comparing the result with the classical proposed by Bianchi [1], resulting in a lightly accurate estimation of throughput and collision probability, for IEEE 802.11 distribution coordination function using the Request to Send/Clear to Send mechanism for wireless sensor networks.

The availability of multiple access alternatives offers the

capability of increasing the overall transmission capacity, providing better service quality, dealing with health problems of wireless systems and reducing the deployment costs for wireless access. This way, practically all existing technologies will become simple RATs (e.g., ZigBee, MTM, HSPA, WLANs, WiMAX, LTE, etc.)

The employed CSMA/CA scheme stipulates that all nodes to listen to the channel occupancy before initiating a transmission as to avoid the packet collisions in the networks. Since all packets have the same priority under CSMA/CA mechanism. Based on the models of Wu and al. [10] and Zorzi and al [3], we investigate the throughput of TCP and FBP under CSMA/CA wireless networks analytically and the analysis is verify again with Matlab. Our preliminary results show that nodes have weak incentive to switch to FBP in CSMA/CA networks when certain conditions are fulfilled.

For the above document, it is easy to give: In section 2 of this document, we briefly describe the analytical model and the operating principal of the IEEE 802.11 MAC layer and motivations. In section 3, we present on the most well-known mathematical model, the section 4 present the numerical solution of our model.

II. THE ANALYTICAL MODEL

A. Overview of the fountain code

Fountain Code [3,9,10] is high performance sparse codes on bipartite graphs. These codes are rateless, the amount of redundancy is not fixed prior to transmission but can be decided on the fly as the error recovery algorithm evolves in the literatures. When a packet did not reach the destination the receiver send the request for retransmission periodically. Michael Luby (2002) [7] proposed a rate-less code with this propriety, can generate a potentially infinite number of code words fountain codes, are near optimal for every erasure channel, despite the probability delta of erasure code.

LT codes is the first code class universal fountain, he propose the law of Robust Soliton Distribution (RSD) as an optimal solution in terms of capacity. The message m with K symbols can be decoded from K' received code-words, with K' a little larger than K .

B. Analytical model of the 802.11 FCE-DCF

A key difficulty in the mathematical modeling performance the 802.11 MAC layer has been studied extensively in the literature lien in the very large number of states that may exist, scaling exponentially with the number of node. When the range of single-hop wireless communication limited by distance or harsh radio propagation conditions.

In our proposed model, we carefully study the ideal channel state analysis based on the two dimensional markov chain approach first proposed by Bianchi, using fountain coding/decoding for each node of the network.

In this section, we describe our mathematical model of the FCE-DCF. In each transmission attempt, regardless of the number of retransmission suffered, each data collides with constant and independent probability: p is the probability that, in a slot time at least one of the $(n-1)$ remaining stations transmits as well.

$$P = 1 - (1 - \tau)^{n-1}$$

FCE-DCF model is the analytical calculation of saturation throughput in a closed-form expression. We derive the relationships between, the probability of collision p , the stationary distribution b , and the probability δ of the fountain decoding process. The transmission probability per station of the Markov chain's transition matrix is:

$$\begin{cases} P\{i,k|i,i+1\} = 1 & k : [0, Wi-2], i : [0, m] \\ P\{0,k|i,0\} = ((1-p)(1-\delta)) / W_0 & k : [0, W_0-1], i : [0, m] \\ P\{0,k|i,0\} = p(1-\delta) / W_0 & k : [0, W_0-1], i : [0, m] \\ P\{i,k|i-1,0\} = \delta p / W_i & k : [0, W_i-1], i : [1, m] \\ P\{i+1,k|m,0\} = \delta p / W_m & k : [0, W_m-1], i : [1, m] \end{cases} \quad (1)$$

The details of its transition probabilities explained as follow: The first equation in (1) accounts for the fact that, at the beginning of each slot time, the backoff time is decremented for each transition in the interval time. The second equation in (1) accounts for the fact that stands for probability that a node goes to the next backoff stage either of the failed successive by collision and successful fountain decoding. The third and fourth equations in (1) accounts for the fact that stands for probability that a node goes to the next backoff stage either of the failed successive by collision and failed fountain decoding, the node is going to idle or sleeping states for waiting for new packets.

The model also calculates the probability of a packet transmission failure due to collision using a fountain code in two part first in the sender and at the receiver. It assumes that the channel is in ideal conditions, there is no hidden terminal and capture effect.

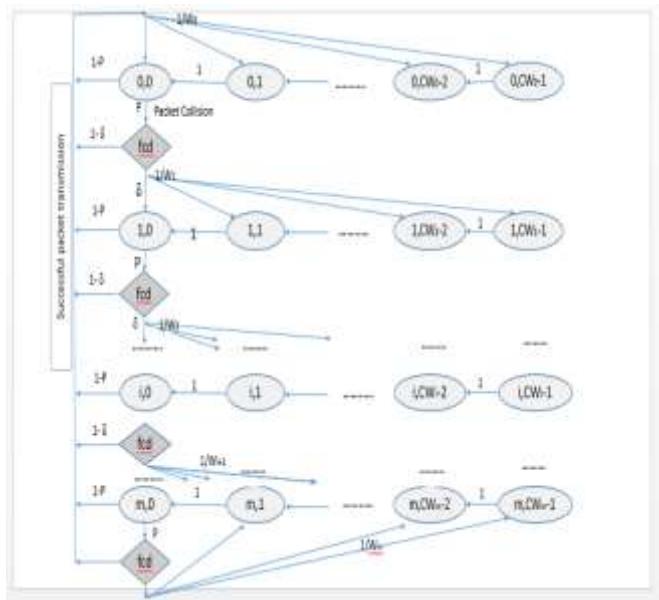


Figure 1. Markov Chain model for the backoff window size using the fountain decoding algorithm.

Analysis: We assume that the network consist of n contending nodes, each node has a packet available for transmission. The backoff timer is uniformly chosen in the range $[0, Wi-1]$ and the probability of collision p of the transmission packet has constant and independent of the retransmission attempt of a packet $CW=CW_{min}$, after unsuccessful transmission CW is doubled up to the maximum value CW_{max} .

Let $b(t)$ be the stochastic process representing the back-off time counter for a given station. The counter, k is initially chosen between $[0, Wi-1]$.

Let $s(t)$ be the stochastic process representing the back-off stage $(0, \dots, m)$ of the station at the time t .

C. Transmission probability per station τ

We can write the probability that a station code this data with fountain code transmits in a randomly chosen slot time as:

$$\tau = \sum_{i=0}^m b_{i,0} \quad (2)$$

From the normalization condition for stationary distribution is applied, $b_{0,0}$ can be write as:

$$b_{0,0} = \frac{(2-4p\delta)(1-p+p(1-\delta))}{(1-2p(1-\delta))(W+1)+p(1-\delta)W(1-(2p(1-\delta))^m)} \quad 0 < i \leq m \quad (3)$$

Proceeding with the traditional computation of the stationary distribution of the Markov chain like in [1,2], a transmission occurs when the back-off time counter is equal to zero. We can write the Probability of a station transmit in randomly chosen slot time equal to:

$$\begin{aligned}\tau &= \sum_{i=0}^m b_{i,0} = \sum_{i=0}^m (\mathbf{P} \delta)^i \cdot b_{0,0} = \frac{b_{0,0}}{1-P\delta} \\ &= \frac{(2-4p\delta)}{(1-2p(1-\delta))(W+1)+p(1-\delta)W(1-(2p(1-\delta))^m)}\end{aligned}\quad (4)$$

III. MATHEMATICAL MODEL

In this section we have developed a mathematical models to compute the throughput of the FCE-DCF in the IEEE 802.11 network, and the comparison with the works that presented in [1,2]. The analysis is carried out for the relationship between packet transmission probability tau, condition collision probability P and the probability of fountain decoding delta.

We can also obtain the following relation between the key parameters p and tau:

$$\tau(p) = \frac{2(1-2\delta p)}{(1-2\delta p)(W+1)+\delta p W(1-(2\delta p)^m)} \quad (5)$$

$$1-p = (1-\tau(p))^{n-1}$$

Firstly, we assume that they are not transmission in the chosen slot time given by the following equation:

$$V(p) = 1 - \tau(p) \quad (6)$$

We obtain the probability that node does not transmit at a chosen slot with time by simplifying the function of the conditional collision probability.

$$V(p) = \frac{w-1+2\delta p+\delta p(1+(2\delta p)^m)}{w+1-2\delta p-\delta p(1+(2\delta p)^m)} \quad (7)$$

To simplify Eq.(12) we use Taylor series expansion to V(p), we can and be written as:

$$V(p) = \frac{w-1}{w+1} + \frac{2\delta w}{(w+1)^2} p + \dots o(p^6) \quad (8)$$

Where O(p6) accounts for the sixth and highest order terms in the Taylor series expansion.

The first order approximation of V(p) as following :

$$V(p) = \frac{w-1}{w+1} + \frac{2\delta w}{(w+1)^2} p \quad (9)$$

We let U = 1-P then P = 1-U

$$\begin{aligned}V(U) &= \frac{w-1}{w+1} + \frac{2\delta w}{(w+1)^2} (1-U) \\ &= \frac{w-1}{w+1} + \frac{2\delta w}{(w+1)^2} (1-U) \\ &= \frac{w^2-1+2\delta w-2\delta wU}{(w+1)^2} \\ &= \frac{w^2+2\delta w-1}{(w+1)^2} - \frac{2\delta wU}{(w+1)^2} \\ &= -\frac{2\delta wU}{(w+1)^2} + e\end{aligned}\quad (10)$$

$$\text{Let } e = \frac{w^2+2\delta w-1}{(w+1)^2}$$

Where w<32 and 0<δ<1 for example w=32 and δ=1

$$\begin{aligned}e &= \frac{w^2+2\delta w-1}{(w+1)^2} \\ &= \frac{32^2+2*32-1}{(32+1)^2} = \frac{1087}{1089} \approx 1\end{aligned}\quad (11)$$

We are now able to rewrite Eq.V(U) which the second term approximately equal 1.

$$V(U) = 1 - \frac{2\delta wU}{(w+1)^2} \quad (12)$$

Where Tau = 1-V

And τ(U) as following Tau(U) = 1-V(U).

By substituting Eq.(10) into Eq.(11) can be tau(U) expressed as follows:

$$\begin{aligned}\tau(U) &= 1 - \frac{2\delta w}{(w+1)^2} U + 1 \\ &= \frac{2\delta w}{(w+1)^2} U\end{aligned}\quad (13)$$

Where P = 1-U then Eq.(13) becomes the following:

$$\begin{aligned}\tau(U) &= \frac{2\delta w}{(w+1)^2} (1-p) \\ &= \frac{2\delta w}{(w+1)^2} (1-p)\end{aligned}\quad (14)$$

$$\begin{aligned}
 U &= \left(1 - \frac{2\delta w}{(w+1)^2} U\right)^{n-1} \\
 U &= \left(1 - \frac{2\delta w}{(w+1)^2} U\right)^{n-1} \\
 U &= 1 - (n-1) \frac{2\delta w}{(w+1)^2} U \\
 1 &= U + (n-1) \frac{2\delta w}{(w+1)^2} U \\
 &= (1 + (n-1) \frac{2\delta w}{(w+1)^2}) U \\
 U &= \frac{(w+1)^2}{w^2 + 2w + 1 + 2n\delta w - 2\delta w}
 \end{aligned} \tag{15}$$

The probability that no node is transmitting at any randomly chosen time slot is given by the following equation:

$$U = (1 - \tau)^{n-1} \tag{16}$$

By substituting Eq.(15) into Eq.(16), U becomes as

$$U = \left(1 - \frac{2\delta w}{(w+1)^2} U\right)^{n-1} \tag{17}$$

To simplify Eq.(17) we use Taylor series expansion U becomes as:

$$\begin{aligned}
 U &= \left(1 - \frac{2\delta w}{(w+1)^2} U\right)^{n-1} \\
 &= 1 - (n-1) \frac{2\delta w}{(w+1)^2} U + (n-1)(n-2) \left(\frac{2\delta w}{(w+1)^2} U\right)^2 \dots
 \end{aligned} \tag{18}$$

By taking the first term from the series the Taylor, U simplified as follows:

$$U = 1 - (n-1) \frac{2\delta w}{(w+1)^2} U \tag{19}$$

After some mathematics simplify in Eq.(18)

$$\begin{aligned}
 U &= 1 - (n-1) \frac{2\delta w}{(w+1)^2} U \\
 1 &= U + (n-1) \frac{2\delta w}{(w+1)^2} U \\
 1 &= (1 + (n-1) \frac{2\delta w}{(w+1)^2}) U \\
 1 &= \left(\frac{w^2 + 2w + 1 + 2n\delta w - 2\delta w}{(w+1)^2}\right) U
 \end{aligned} \tag{20}$$

We have got formulate of P by changing U by (1-P) in last equation:

$$\begin{aligned}
 1-P &= \frac{(w+1)^2}{w^2 + 2w + 1 + 2n\delta w - 2\delta w} \\
 p &= 1 - \frac{(w+1)^2}{w^2 + 2w + 1 + 2n\delta w - 2\delta w} \\
 p &= \frac{w^2 + 2w + 1 + 2n\delta w - 2\delta w - (w+1)^2}{w^2 + 2w + 1 + 2n\delta w - 2\delta w} \\
 p &= \frac{2n\delta w - 2\delta w}{w^2 + 2w + 1 + 2n\delta w - 2\delta w}
 \end{aligned}$$

$$\text{Or } p = \frac{2\delta w(n-1)}{(w+1)^2 + 2\delta w(n-1)} \tag{21}$$

Where $w \gg 1$ (32,64,128...) and $n \gg (10,20,50,100\dots)$
We can approximate Eq.(21) as :

$$p = \frac{2\delta w(n-1)}{w^2 + 2\delta w(n-1)} \tag{22}$$

The following equations explain the proposed approximation method for estimation the packet transmission probability.

$$\begin{aligned}
 \tau(p) &= \frac{2(1-2\delta p)}{(1-2\delta p)(W+1) + \delta p W(1-(2\delta p)^m)} \\
 &= \frac{2}{(W+1) + \delta p W \frac{(1-(2\delta p)^m)}{(1-2\delta p)}}
 \end{aligned} \tag{23}$$

Where $W > 32$ Eq.(23) can be approximate as following:

$$\begin{aligned}
 \tau(p) &= \frac{2}{W + \delta p W \frac{(1-(2\delta p)^m)}{(1-2\delta p)}} \\
 \tau(p) &= \frac{2}{W(1 + \delta p \frac{(1-(2\delta p)^m)}{(1-2\delta p)})} \\
 &= \frac{2}{W \frac{1 - 2\delta p + \delta p(1-(2\delta p)^m)}{(1-2\delta p)}}
 \end{aligned} \tag{24}$$

Finally Eq(24) can be rewritten after approximation:

$$\tau(p) = \frac{2(1-2\delta p)}{W(1-\delta p(1+(2\delta p)^m))} \tag{25}$$

Finally from our approximation for P, and the packet transmission probability tau of approximation mathematical model rewritten as:

$$\begin{cases} \tau_{ap} = \frac{2(1-2\delta p)}{W(1-\delta p(1+(2\delta p)^m))} \\ p_{ap} = \frac{2\delta(n-1)}{W+2\delta p(n-1)} \end{cases} \tag{26}$$

If $n \gg 10$, P_{ap} rewritten as follows.

$$P_{ap} = \frac{2\delta n}{W + 2\delta n} \quad (27)$$

From the [2] the packet transmission probability P and the probability of collision of the FCE-DCF for (P) written as:

$$\tau_{fc} = \frac{2(1 - 2\delta p_{fc})}{(1 - 2\delta p_{fc})(W+1) + \delta p_{fc}W(1 - (2\delta p_{fc})^m)} \quad (28)$$

$$p_{fc} = 1 - (1 - \tau_{fc})^{n-1}$$

IV. NUMERICAL RESULTS

A. Derivation of average throughput

From the system of two nonlinear equations that has a unique solution and can be solved numerically for the approximation values of p_{ap} and τ_{ap} . The saturation throughput, which is the average information payload transmitted in a slot time over the average duration of a slot time, can be compute as follows:

$$S_{ap} = \frac{P_{s-ap} P_{tr-ap} L}{P_{s-ap} P_{tr-ap} T_s + (1 - P_{s-ap}) T_c + (1 - P_{tr-ap}) T_{id}} \quad (29)$$

Where $P_{tr-ap} = 1 - (1 - \tau_{ap})^n$ is the probability that here is at least a transmission in the considered slot time, L is the average packet payload size, and T_{id} is the duration of the idle period.

Let P_{s-ap} be the probability that one station transmits one the channel, which is conditioned by the fact at least one station transmits, and when packets encounters a collision which the successful fountain decoding.

$$P_{s-ap} = \frac{(n\tau_{ap} - (1 - \delta))(1 - \tau_{ap})^{n-1} + (1 - \delta)}{P_{tr-ap}} \quad (30)$$

Let T_s the time when the channel sensed by a successful transmission.

Let T_c the time that the channel is sensed busy by a missed transmission.

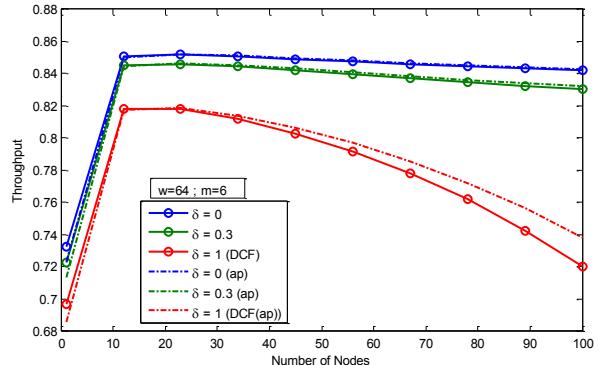
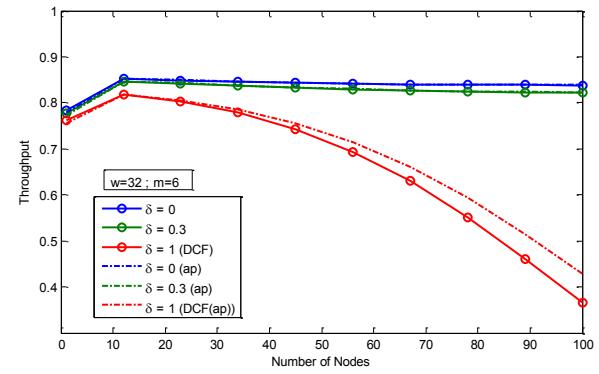
$$\begin{cases} T_s = RTS + SIFS + 4\sigma + CTS + SIFS + H + L + SIFS + ACK + DIFS \\ T_c = RTS + DIFS + \sigma \end{cases} \quad (31)$$

Where H the transmission times needed to send the packet header, L the payload, ACK the acknowledgment, and σ is the propagation delay. They are independent of system parameters. Using the same parameter presented in [2] for calculate the throughput.

TABLE I. DESCRIBES THE ITEMS THAT ARE KEPT FOR DIFFERENT SIMULATIONS.

parameters	values
packet payload	8184 bits
MAC header	272 bits
PHY header	128 nits
ACK	112 bits +PHY header
RTS	160 bits +PHY header
CTS	112 bits +PHY header
Channel Bit Rate	1 Mbits/s
Slot Time	50μs
Propagation Delay	1μs
SIFS	28μs
DIFS	128μs
ACK_Timeout	300μs
CTS_Timeout	300μs

The idea here is to use a probability of fountain code to improve the success probability for the ideal channel conditions. The figures illustrate this operation, using the parameters reported in table I.



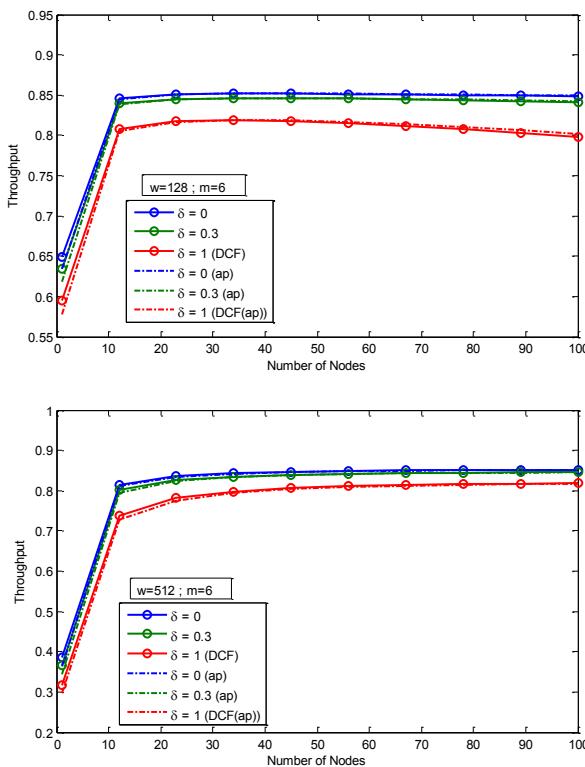


Figure 2.Comparaison between the numerical and simulation Results for Performance of the throughput various number of nodes for the RTS/CTS mechanism.

This figure demonstrates comparison between our linear approximation mathematical model and the model proposed in [1,2] for a system throughput versus number of nodes at $m=6$ and different values of backoff window (CW). It's an interesting study because his give a same result when we increase the backoff window and number of nodes as like a greater network application .However, we can be used like this approximation for calculate the different parameter of system as a throughput, energy efficiency and the delay The difference between Bianchi model [1] and our approximation due a collision that can occur in RTS and STS, when all nodes have a data to transmits in the network and hearing the channel, because the collision probability increases when the number of nodes increases.

V. CONCLUSION

The paper presents the relationship between packet transmission probability tau, conditional collision probability P versus the probability of fountain decoding delta for the proposed linear mathematical approximation models and compare this result by a result obtained in analytical model used in [1,2]. A slight modification in the protocol can result in further performance improvement in terms of throughput, delay and energy efficiency. Our future work direction work is calculate the energy efficiency and the delay including the comparison with our model using fountain code and Bianchi's model. We can now solve the system non-linear of two unknown tau and p, using this approximation

mathematical. However, this equation can be easily solved by numerical technique.

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Enhanced Privacy Preserving Model for Data Using (α, β, k)-Anonymity Model and Lossy join

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Abstract—This paper aims to provide enhancements in the privacy preserving model that was published in our previous paper entitled "An Effective Privacy Preserving Model for Databases Using (α, β, k) - Anonymity Model and Lossy Join" [1]. The previous paper includes a model that maintains the privacy of the multiple sensitive data after the publication of the data in two tables: one for QI-tuples and the other for sensitive attributes. This model used the connecting numbers which depend on one of the sensitive attributes as in lossy join technique. The authors found that in some cases there is a problem may arise with retrieving the exact frequency for any of the rest sensitive attributes if they are not included, as a set of attributes in the same tuple in sensitive attributes table. In other words, the frequency of any one of the rest sensitive attributes is different from the existing frequency of the same attribute in original table especially if the researcher doesn't use all sensitive attributes in the same tuple together as a set. This problem may affect the ability of researchers to utilize the data and consequently affect the research accuracy. This paper proposed a solution for this problem by adding the frequency details in published sensitive data table for the sensitive attributes that are not used in making connecting numbers. The solution will increase the data utility and improve the research accuracy.

Index Terms—Privacy Preserving Model, Anatomy Technique, lossy join, Multiple Sensitive Attributes, Connecting Numbers.

This paragraph of the first footnote will contain the date on which you submitted your paper for review. It will also contain support information, including sponsor and financial support acknowledgment. For example, "This work was supported in part by the U.S. Department of Commerce under Grant BS123456".

The next few paragraphs should contain the authors' current affiliations, including current address and e-mail. For example, F. A. Author is with the National Institute of Standards and Technology, Boulder, CO 80305 USA (e-mail: author@ boulder.nist.gov).

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I. INTRODUCTION

Data mining is an increasingly important technology for extracting useful knowledge hidden in huge collections of data [2-6]. Data Mining also possible defined as an analysis process of large quantities of data in order to discover meaningful patterns and rules. There are, however, negative social perceptions about data mining, among which potential privacy violation and potential discrimination [7, 8]. Any data mining model generally assumes that the underlying data is freely accessible. The former is an unintentional or deliberate disclosure of a user profile or activity data as part of the output of a data mining algorithm or as a result of data sharing. Even removing identifiers data is not secured, and causes linking attacks [9]. For this reason, privacy preserving data mining has been introduced to protect individual privacy. Privacy preserving data mining (PPDM) has become more and more important because it allows sharing of privacy sensitive attributes for analytical purposes. A big number of privacy techniques were developed most of which used the k -anonymity property. K -anonymity is the emerging concept for the protection of released data [10-15]. Anonymity typically refers to the state on individual's personal identity or personally identifiable information, being publically unknown. When released information linked with confidential table may cause data disclosures. Anonymity model introduced to control linking attack. K -anonymity model suggests to convert identifiers (Quasi identifiers, who are responsible for linking attack) in such a manner that adversary doesn't infer the sensitive attributes related to them. On the other hand, it is difficult for a data publisher to generate anonymous table, when multiple sensitive attributes are present in data set because concentrating to protect one sensitive attribute may cause disclosure of identity due to another one [14]. An attempt to solve that problem was introduced in [1] that includes a proposed model that maintains the privacy of the multiple sensitive attributes. This previous model solves this problem by publication data in two tables: one for QI-tuples and the other for sensitive attributes. It uses the connecting numbers which depend on one of the sensitive attributes. In the previous proposed model in [1], there is a problem may arise if researcher intended to know the frequency of any one of the rest sensitive attributes. The authors found that this

frequency is different from that in original table especially if the researcher doesn't treat all together as a set. Therefore, authors proposed an enhanced new model to avoid this problem using the frequency details in published sensitive attributes table. This frequency details enable researcher to know in exact the correct frequency number for each of the rest sensitive attributes as explained later in this paper. In the next section authors discuss multiple sensitive attributes. Section (3) presents a previous attempt of privacy preserving for databases, (α, β, k) -anonymity model, and applies lossy join with k -anonymity techniques. Section (4) presents privacy preserving using anatomy technique. Section (5) introduces implementation of the enhanced proposed model.

II. MULTIPLE SENSITIVE ATTRIBUTES

Sensitive attribute is an attribute whose value for some particular individual must be kept secret from people who have no direct access to the original data [1, 12]. Data publisher needs to prevent privacy disclosure which means someone can simply attack the published table "T" and at least know the individuals' confidential information like knowing that he could suffer from some kinds of dangerous disease [13]. Information disclosure could be of three types as follows [1, 14]:

- Attribute disclosure: sensitive attribute information of an individual is disclosed.
- Identity disclosure: an individual is linked to a particular record in the published data.
- Membership disclosure: information about whether an individual's record is in the published data or not is disclosed.

K -anonymity model was introduced to protect sensitive attributes from interlopers. Therefore, if an adversary wants to search an individual's identity and has knowledge about quasi-identifiers, he should find $k-1$ records that satisfy quasi-identifiers [14]. On the other hand, when multiple sensitive attributes are present in records, data publishers have to face a big problem in maintaining privacy for all these attributes together. Table I shows 4-anonymous inpatient microdata and Table II shows a description of dataset [14, 15]. Table II includes the sensitive attributes: "Medical Status", "Occupation", and "Annual Income". When a data publisher concentrates to protect one sensitive attribute may cause disclosure of identity due to another one [14]. Therefore, we need a model to control all sensitive attributes together.

III. A PREVIOUS ATTEMPT OF PRIVACY PRESERVING FOR DATABASES

In this section, the authors present the previous paper entitled "An Effective Privacy Preserving Model for Databases Using (α, β, k) - Anonymity Model and Lossy Join" [1]. The previous paper introduced a model that solves the problem of maintaining the multiple sensitive attributes privacy introduced in section 2 through the publication of data in two tables: one for QI-tuples and the other for sensitive attributes. In the following sub-sections, the authors will present the main problem definition of previous proposed

model in [1], (α, β, k) -anonymity model and the previous proposed algorithm for using k -anonymous model with lossy join which helps to solve protecting multiple sensitive attributes privacy problem [1].

TABLE I
4-Anonymous Inpatient Microdata

Ser. No	NONSENSITIVE			SENSITIVE
	Zip Code	Age	Nationality	Medical
1	130***	<30	*	Heart
2	130***	<30	*	Heart
3	130***	<30	*	HIV
4	130***	<30	*	HIV
5	1485**	>40	*	Cancer
6	1485**	>40	*	Heart
7	1485**	≥40	*	HIV
8	1485**	≥40	*	HIV
9	130***	3*	*	Cancer
10	130***	3*	*	Cancer
11	130***	3*	*	Cancer
12	130***	3*	*	Cancer

TABLE II
Classification of Attributes

Ser. No	ATTRIBUTE	TYPE
1	ZIPCODE	NON-SENSITIVE
2	AGE	NON-SENSITIVE
3	NATIONALITY	NON-SENSITIVE
4	MEDICAL_STATUS	SENSITIVE
5	OCCUPATION	SENSITIVE
6	ANNUAL_INCOME	SENSITIVE

A. The Previous Proposed Model Problem Definition:

The identities and accurately QI -attributes values of all individuals could be mastered by an attacker, using background knowledge [16]. This background knowledge can be detected from external tables and be contained in an equivalent class. Our previous proposed model intended to solve this problem with multiple sensitive attributes that can be explained using the following example:

- Assume the data in Table III need to be published by publishers, such as a hospital or an insurance company. Both disease and salary are sensitive attributes.
- Table IV is an anonymous data table of Table III. Although disease attributes and the salary attributes both conform to 3-diversity rules in Table IV, it cannot prevent the attack of the background knowledge as explained in the following cases:
 - If an attacker knows information about someone named "Ali" is in the second QI -group, and knows that salary of "Ali" is not "2000" according he/she has mastered background knowledge, and then the attacker can infer that "Ali" suffered from "Catatonia".
 - If an attacker knows information about someone named "Iman" is in the first QI -group and knows that salary of "Iman" is not "6000", and then the attacker can infer that "Iman" suffered from "Depression".

- Although the sensitive attributes conform to L-diversity [17], privacy information still is leaked. The main reason is that there is a less diversity between multiple sensitive attributes.

The previous proposed model in [1] solved this problem, maintaining the privacy of the data to a large extent, as explained in the following subsections.

TABLE III
Microdata

ID	QI			SA	
	Sex	Age	Zip code	Salary(S_1)	Disease(S_2)
T1	F	30	66212	6000	Headache
T2	F	28	66251	4000	Depression
T3	F	26	66253	2000	Depression
T4	F	26	66252	6000	Paranoia
T5	M	39	63223	5000	Catatonia
T6	M	40	65262	2000	Paranoia
T7	M	36	63232	6000	Catatonia
T8	M	35	65261	2000	Insomnia

TABLE IV
Anonymized Table

ID	QI			SA	
	Sex	Age	Zip code	Salary(S_1)	Disease(S_2)
T1	F	[25-30]	66***	6000	Headache
T2	F	[25-30]	66***	4000	Depression
T3	F	[25-30]	66***	2000	Depression
T4	F	[25-30]	66***	6000	Paranoia
T5	M	[35-40]	6****	5000	Catatonia
T6	M	[35-40]	6****	2000	Paranoia
T7	M	[35-40]	6****	6000	Catatonia
T8	M	[35-40]	6****	2000	Insomnia

B. (α, β, k) -Anonymity Model

Let a Table "T" that contains a set of attributes (A_1, \dots, A_n). This attributes could be divided into two separate categories. First category represents non-sensitive attributes (Q_1, \dots, Q_m) and the second category represents sensitive attributes (S_1, \dots, S_i). The number of tuples is QI_n in QI -group [18]. The number of distinct values of sensitive attribute S_i is nS_i , and the corresponding number of distinct sensitive attribute values is nS'_i in S_i of all the same sensitive attribute values in S_{i-l} . "T" is said to satisfy (α, β, k) anonymity if and only if:

- 1) T satisfies k-anonymity,
- 2) the number of distinct values for each sensitive attribute occur at least β times ($2 \leq \beta \leq k$) within the same QI -group, and
- 3) $\alpha = nS_i - nS'_i \neq 1$ in each QI -group of tuples.

To illustrate this anonymity approach, we analyze the data from Table IV that satisfies 4-anonymity with respect to Sex, Age and Zip code and includes two QI -groups.

- The first group has three different diseases and three different salaries,
- The second group also has three different diseases and three different salaries; Therefore $\beta=3$.
- In the first group, $nS_l=nS_2=3$, $nS'_2=2$ because the corresponding distinct disease attribute values are

- "Headache" and "Paranoia" of the same salary attribute values {6000, 6000} in the salary attributes.
- Thus, $\alpha = nS_2 - nS'_2 = 3-2=1$, it is not satisfies (α, β, k) -anonymity.

From previous analyses we know that Table IV will lead to a leakage of privacy information, that is, if $\alpha=1$, it will cause a leakage if an attacker has a background knowledge. Previous proposed model in [1] was adopted to solve the above problem.

C. Applying Lossy Join with K-anonymity Technique

This section introduces lossy join technique explaining how it is useful to conceal sensitive attributes and how to apply it with (α, β, k) -Anonymity.

1) The Lossy Join Technique

In recent work, lossy Join is useful in privacy preserving data publishing [19]. The idea of this technique is that if two tables with a join attribute are published, the join of the two tables can be lossy and this lossy Join, helps to conceal the private information. The idea of lossy join is used to derive a new mechanism for achieving a similar privacy preservation target.

- Let us have a look at an example in Table V, A (0.5, 2)-anonymization. From this table, we can generate a Temp table as shown in Table VI.
- For each equivalence class "E" in the anonymized table, author assigns a unique identifier (ID) to "E" and also to all tuples in "E".
- Then, author attaches the correspondence (ID) to each tuple in the original raw table and forms a new table "Temp".
- From the Temp table, we can generate two separate tables, Tables VII (a) and VII (b).
- The two tables share the attribute of ClassID.
- If we join these two tables by the ClassID, it is easy to see that the join is lossy and it is not possible to derive the Temp table after the join.
- The result of joining the two tables is given in Table VIII.

TABLE V
A (0.5, 2)-anonymization Table

Job	Birth	Postcode	Disease
Clerk	1975	4350	HIV
manager	1955	4350	flu
clerk	1955	5432	flu
factory worker	1955	5432	fever
factory worker	1975	4350	flu
technical supporter	1940	4350	fever

TABLE VI
Temp Table

Job	Birth	Postcode	Disease	ClassID
Clerk	1975	4350	HIV	1
manager	1955	4350	flu	1
clerk	1955	5432	flu	2
factory worker	1955	5432	fever	2
factory worker	1975	4350	flu	3
technical supporter	1940	4350	fever	3

TABLE VII (a)
NSS Table

Job	Birth	Postcode	ClassID
Clerk	1975	4350	1
manager	1955	4350	1
Clerk	1955	5432	2
factory worker	1955	5432	2
factory worker	1975	4350	3
technical supporter	1940	4350	3

TABLE VII (b)
SS Table

ClassID	Disease
1	HIV
1	Flu
2	Flu
2	Fever
3	Flu
3	Fever

TABLE VIII
Joining the Two Tables (7-a) & (7-b)

Job	Birth	Postcode	Disease	Class
clerk	1975	4350	HIV	1
manager	1955	4350	HIV	1
clerk	1975	4350	flu	1
manager	1955	4350	flu	1
clerk	1955	5432	flu	2
factory	1955	5432	flu	2
clerk	1955	5432	fever	2
factory	1955	5432	fever	2
factory	1975	4350	flu	3
technical	1940	4350	flu	3
factory	1975	4350	fever	3
technical	1940	4350	fever	3

- From the lossy join, each individual is linked to at least 2 values in the sensitive attribute. Therefore, the required privacy of individual can be guaranteed.
- In the joined table, for each individual, there are at least 2 individuals that are linked to the same bag "B" of sensitive attributes values, such that in terms of the sensitive values, they are not distinguishable.
- The first record in the raw table (QID= (clerk, 1975, 4350)) is linked to bag {HIV, flu}.
- The second individual (QID = (manager, 1955, 4350)) is also linked to the same bag "B" of sensitive attributes values.
- This is the goal of k-anonymity for the protection of sensitive attributes values.

2) Applying Lossy Join Approach with (α, β, k) -Anonymity Model

Lossy Join Technique is adopted to solve above problem in III.A by previous proposed model in paper [1]. The author gives a set different number for each salary as shown in Table IX in "Connecting Numbers" column, and then uses these numbers to build both tables as shown in Table X and Table XI. By joining the two Tables X and XI with these connecting numbers Table XII could be produced.

To illustrate this anonymity approach, we analyze the data from Table XII that satisfies 7-anonymity with respect to

"Sex", "Age" and "Zip code" includes two QI-groups [1] as follows:

- The first group has five different diseases and three different salaries,
- The second group also has five different diseases and three different salaries; Therefore, at least $\beta=3$.

TABLE IX
Anonymized Table with Connecting Numbers.

ID	QI			SA		Connecting Numbers
	Sex	Age	Zip	Salary(S_1)	Disease(S_2)	
T1	F	[25-	66***	6000	Headache	1(for 6000)
T2	F	[25-	66***	4000	Depression	2(for 4000)
T3	F	[25-	66***	2000	Depression	3(for 2000)
T4	F	[25-	66***	6000	Paranoia	1(for 6000)
T5	M	[35-	6****	5000	Catatonia	4(for 5000)
T6	M	[35-	6****	2000	Paranoia	3(for 2000)
T7	M	[35-	6****	6000	Catatonia	1(for 6000)
T8	M	[35-	6****	2000	Insomnia	3(for 2000)

TABLE X
QI-Tuples with Connecting Numbers

ID	QI			Connecting Numbers
	Sex	Age	Zip code	
T1	F	[25-30]	66***	1
T2	F	[25-30]	66***	2
T3	F	[25-30]	66***	3
T4	F	[25-30]	66***	1
T5	M	[35-40]	6****	4
T6	M	[35-40]	6****	3
T7	M	[35-40]	6****	1
T8	M	[35-40]	6****	3

TABLE XI
Sensitive attributes with Connecting numbers

Connecting Numbers	SA	
	Salary(S_1)	Disease(S_2)
1	6000	Headache
2	4000	Depression
3	2000	Depression
1	6000	Paranoia
4	5000	Catatonia
3	2000	Paranoia
1	6000	Catatonia
3	2000	Insomnia

TABLE XII
Tuples with Sensitive using Connecting Numbers

ID	QI			Connecting Numbers	SA	
	Sex	Age	Zip		Salary(S_1)	Disease(S_2)
T1	F	[25-	66***	1	6000	Headache
T2	F	[25-	66***	1	6000	Paranoia
T3	F	[25-	66***	1	6000	Catatonia
T4	F	[25-	66***	2	4000	Depression
T5	F	[25-	66***	3	2000	Paranoia
T6	F	[25-	66***	3	2000	Depression
T7	F	[25-	66***	3	2000	Insomnia
T8	M	[35-	6****	3	2000	Paranoia
T9	M	[35-	6****	3	2000	Depression
T10	M	[35-	6****	3	2000	Insomnia
T11	M	[35-	6****	4	5000	Catatonia
T12	M	[35-	6****	1	6000	Headache
T13	M	[35-	6****	1	6000	Paranoia
T14	M	[35-	6****	1	6000	Catatonia

- In the first group, $nS_1=3$ $nS_2=5$, $nS'_2=3$ because the corresponding distinct Disease attribute values are "Headache", "Paranoia" and "Catanoia" of the same salary attribute values {6000, 6000, 6000} in the salary attributes ,and

- The corresponding distinct Disease attribute values are "Depression", "Paranoia" and "Insomina" of the same Salary attribute values {2000, 2000, 2000} in the Salary attributes.
- Thus, $\alpha = nS_2 - nS'_2 = 5-3=2$, it satisfies (α, β, k) -anonymity.
- In the second group, $nS_1=3$ $nS_2=5$, $nS'_2=3$ because the corresponding distinct Disease attribute values are "Headache", "Paranoia" and "Catanoia" of the same salary attribute values {6000, 6000, 6000} in the Salary attributes ,and
 - The corresponding distinct Disease attribute values are "Depression", "Paranoia" and "Insomina" of the same salary attribute values {2000, 2000, 2000} in the Salary attributes.
 - Thus, $\alpha = nS_2 - nS'_2 = 5-3=2$, it satisfies (α, β, k) -anonymity.
- Figure I represents (α, β, K) test Architecture and Figure II represents the previous proposed model architecture.

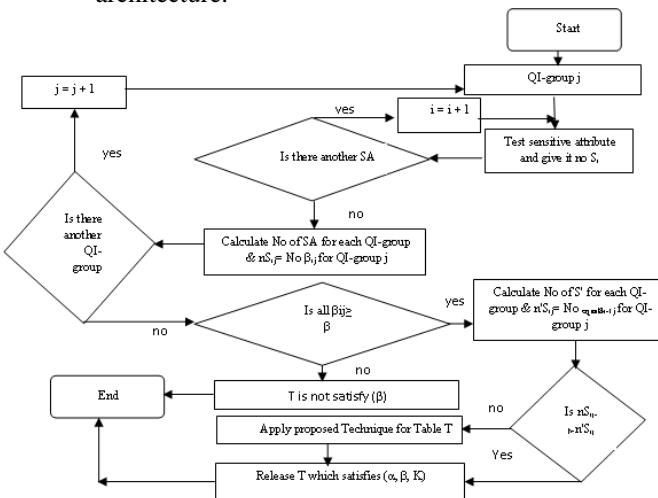


FIGURE I
 (α, β, K) Test Archetecture

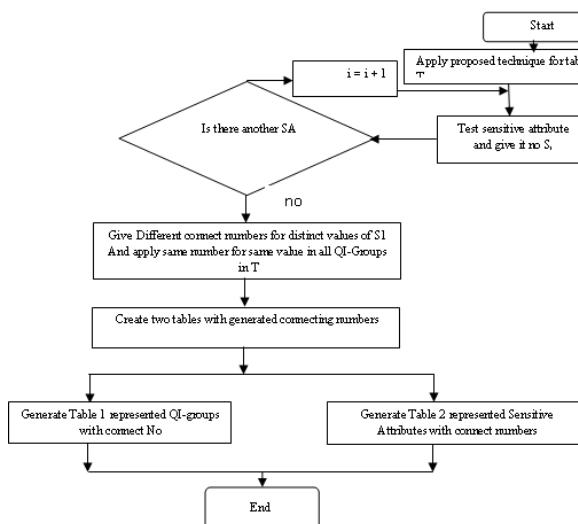


FIGURE II
Previous Proposed Technique Architecture

IV. PRIVACY PRESERVING USING ANATOMY TECHNIQUE

Anatomy technique aims to release two different tables Quasi-Identifier (*QI*) attributes table and Sensitive Table (*ST*) for Sensitive Attributes (*SA*) instead of publishing unique table with the generalized values [20,21]. There is no need to modify the original table because anatomy releases all *QIs* and *ST* directly in two separate tables, which met *L*-diversity privacy requirement [20]. Anatomy technique has been proposed to overcome the disadvantages of generalization which often losses considerable information in the microdata.

Anatomy captures the exact *QI*-distribution and releases two tables, a quasi-identifier table (*QIT*) and a sensitive table (*ST*), which separate *QI*-values from sensitive attributes values. For example, Tables XIV (a) and XIV (b) demonstrate the *QIT* and *ST* obtained from the microdata Table XIII, respectively [20]. The technique methodology could be explained as follows:

- First, the microdata partitioned the records into different *QI-groups*, based on a certain strategy. If the reader following the grouping in Table XIII, he will find that records from "1" to "4" are grouped into *QI-group* number "1" and records from "5" to "8" into *QI-group* number "2".
- Second, the quasi-identifier table (*QIT*) has been created. Specifically, for each record in Table XIII, the *QIT* (Table XIV (a)) includes all its exact *QI-values*, together with its group membership in a new column *Group-ID*. However, *QIT* doesn't have any disease value.
- Finally, it is possible to say that *ST* (Table XIV (b)) maintains the disease statistics of each *QI-group*.

The *QIT* doesn't indicate the sensitive value of any record which must randomly be guessed from the *ST* so anatomy preserves privacy. To explain this, consider the adversary who has the age "25" and Zip code "11500" of "Ali". Hence, from the *QIT* (Table XIV (a)), the adversary knows that record "1" belongs to "Ali", but doesn't obtain any information about his disease so far. Instead, s/he gets the *id* "1" of the *QI-group* containing record "1". Judging from the *ST* (Table XIV (b)), the adversary realizes that, among the "4" records in *QI-group* "1", 50% of them are associated with "pneumonia" (or "dyspepsia") in the microdata. Note that s/he doesn't gain any additional information, regarding the exact diseases carried by these records. Hence, s/he could only expect that "Ali" could have contracted "pneumonia" (or "dyspepsia") with 50% probability.

V. IMPLEMENTATION OF THE ENHANCED PROPOSED MODEL

The authors introduce the present problem definition with an example that explains it and elucidates how the enhanced proposed model solves this problem.

A. Present Problem Definition

In previous proposed model in [1] it is assumed that researcher takes all sensitive attributes in the same tuple in the

sensitive table (ST) as a set. If researcher divides this tuple set into separate sensitive attributes values he may face problem especially if he needs to know the frequency of each separate sensitive attribute (except those attribute that is used as a basis for connecting numbers). The authors noticed this problem in applying the previous proposed model as explained in the following example:

- When the authors take the two published Tables X and XI mentioned before they noticed that if the researcher wants to know the exact numbers of people who have the same sensitive attribute he cannot reach the correct number as explained in the next two cases:
- Case I:** When researcher tries to calculate total numbers of people who have the same salary set he could only get the frequency number from Table XI by counting frequency of each number in that table as explained in Table XV (a). From Table XV (a) for example we find that the salary set (6000) has frequency = 3 which equal exactly to the same frequency in original Table IX (as tuples "T1", "T4" & "T7"). We could apply the same thing for all other salary sets which give the same frequency as original Table IX. The process of finding the frequency number is easy to be retrieved because the salary set is used as a basis for connecting numbers between the two published tables.

TABLE XIII
The Microdata

Tuple ID	Age	Sex	Zipcode	Disease
1(Ali)	25	M	11500	Pneumonia
2	29	M	13200	dyspepsia
3	33	M	59300	dyspepsia
4	55	M	12700	pneumonia
5	60	F	54600	Flu
6	59	F	25200	gastritis
7(Hoda)	60	F	25100	Flu
8	58	F	31000	bronchitis

TABLE XIV (a)
The Quasi-identifier Table (QIT)

Row Number	Age	Sex	Zipcode	Group-ID
1(Ali)	25	M	11500	1
2	29	M	13200	1
3	33	M	59300	1
4	55	M	12700	1
5	60	F	54600	2
6	59	F	25200	2
7(Hoda)	60	F	25100	2
8	58	F	31000	2

TABLE XIV (b)
The Sensitive Table (ST)

Group-ID	Disease	Count
1	Dyspepsia	2
1	Pneumonia	2
2	Bronchitis	1
2	Flu	2
2	Gastritis	1

- Case II:** When researcher tries to calculates total numbers of people who have the same disease (for

example "Depression") he could return to Table XII to know that "Depression" disease has connecting numbers "2" and "3" and when researcher returns to Table X and put "Depression" disease in front of the same connecting numbers "2" and "3", he could build Table XV (b). From Table XV (b) the researcher found that the total number for people who are sick with "Depression" disease are "4" people (explained with the same red color in Table XV (b)). This number is different from the number in original Table IX (as tuples "T2" & "T3") that equal only "2", which consequently affects negatively with research results accuracy.

From the previous display, it is clear that there is no problem with the frequency of sensitive attribute used as a basis for connecting numbers (Salary), but the problem arises when we are trying to figure out the frequency of other sensitive attribute (Disease).

TABLE XV (a)

Frequency of Each Salary Set According to Connecting Numbers in Table IX

Connecting Number	SA	
	Salary(S_i)	Salary Set Frequency
1	6000	3
2	4000	1
3	2000	3
4	5000	1

TABLE XV (b)

People Who are Sick with Depression Disease According to Connecting Numbers

ID	QI			Connecting Numbers	Disease
	Sex	Age	Zip code		
T1	F	[25-30]	66***	1	
T2	F	[25-30]	66***	2	Depression
T3	F	[25-30]	66***	3	Depression
T4	F	[25-30]	66***	1	
T5	M	[35-40]	6****	4	
T6	M	[35-40]	6****	3	Depression
T7	M	[35-40]	6****	1	
T8	M	[35-40]	6****	3	Depression

B. The Enhanced Proposed Model

The authors provide solution for the present problem explained in previous sub-section 5.1 by adding frequency details column (as count column used in anatomy ST Table XIV (b)). This column gives the exact number of sensitive attribute frequency as in original table for the rest sensitive attributes except that is used as a basis for connecting numbers.

Frequency details column used only as a guide for researchers, informing them about frequency number of sensitive attributes (except that is used as a basis for connecting numbers in original table), which reflects the accuracy of research results.

Applying the Proposed Solution:

According to the enhanced proposed model the solution could be implemented as in the next two Tables (XVI &XVII):

- First Table XVI represents *QI*-Tuples with connecting numbers as the same published table (Table X) in [1] without any changes.
- Second Table XVII represents sensitive attributes with frequency details. In this table, the frequency details presents only the frequency for sensitive attributes (except that is used as a basis for connecting numbers in original table) regardless of the connecting numbers or category link salary. This table is different from sensitive attributes table (Table XI) in [1] by adding this frequency details column which helps researchers to figure out the frequency number of all sensitive attributes exactly. Proposed model architecture presented in Figure III.

TABLE XVI
QI-Tuples with Connecting Numbers

ID	QI			Connecting Numbers
	Sex	Age	Zip code	
T1	F	[25-30]	66***	1
T2	F	[25-30]	66***	2
T3	F	[25-30]	66***	3
T4	F	[25-30]	66***	1
T5	M	[35-40]	6****	4
T6	M	[35-40]	6****	3
T7	M	[35-40]	6****	1
T8	M	[35-40]	6****	3

TABLE XVII

Sensitive Data with Connecting Numbers & Frequency Details

Connecting Numbers	SA		Frequency Details
	Salary(S1)	Disease(S2)	
1	6000	Headache	1
2	4000	Depression	2
3	2000	Depression	-
1	6000	Paranoia	2
4	5000	Catatonia	2
3	2000	Paranoia	-
1	6000	Catatonia	-
3	2000	Insomnia	1

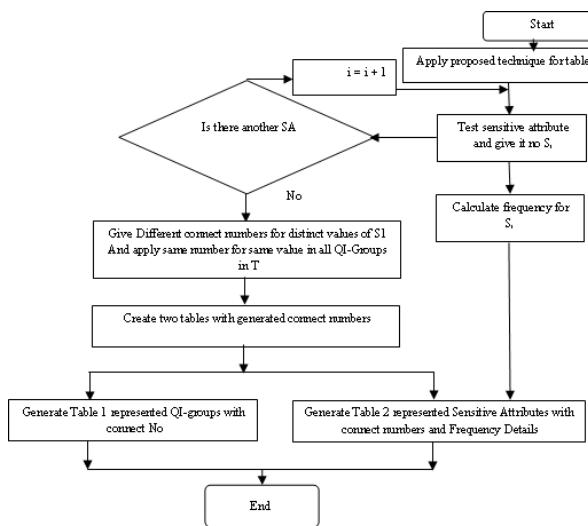


FIGURE III
Proposed Technique Architecture

VI. CONCLUSION AND FUTURE WORK

This paper proposed to solve the problem that may occur in our previous proposed model (α, β, k)-anonymity model in [1]. Although the previous model has positive effect for multiple sensitive attributes privacy and also it helps anonymous data effectively to resist background knowledge attack but one problem may occur. This problem may arise if researcher tries to figure out the exact frequency number of the rest sensitive attributes (except that is used as basis for connecting numbers) and doesn't consider all sensitive attributes in the same tuple together as a set. In other words, the frequency of any one of the rest sensitive attributes is different from the existing frequency of the same attribute in original table. Authors solve this problem by adding frequency details in sensitive attributes table. By adding frequency details, authors solve data utility problem and make the model more efficient for both data privacy and data utility. Frequency details affect research accuracy and help researcher to find answers for some important questions, especially for those imply the frequency number of any sensitive attributes in original data table. Authors intends in future solve the same problem using a hash function technique.

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Evaluating the Sustainability of Cashless Policy with Available ATM Machines Using Akure South Local Government as a Case Study

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Abstract

Recently in Nigeria, the CBN came up with a gradual introduction of cash-less policy and this have constituted a controversial subject of debate at different levels of discussions and consequently becoming an interesting area of research. In this research, a Cashless Society is viewed as a society in which plastic money or any other technology that supports virtual transfer of money for goods purchased or services rendered are the sole modes of payment rather than as a society that operates the trade by barter system as the sole means of payment. The policy thrust of cashless policy centers on the use of electronic system for payment for goods and services instead of the presently used paper money. The successful realization of the policy thrust of cashless society rest entirely on the financial services rendered by banks and other financial institutions on one hand and accessibility of banking facilities by the people on the other. The Financial systems, all over the world are charged with the responsibility of providing the means through which goods and services could be conveniently paid for by buyers. One of the services provided by banks is electronic banking which is inclusive of ATM that allows withdrawal of cash and transferring of fund from one account to another.

Against this background, this study examines the introduction of cash-less policy by the CBN and the ATMs owned by banks with a view to evaluating the sustainability of the policy by the available ATMs using Akure South Local Government in Ondo State, Nigeria as a case study. The available ATMs in the local government were enumerated and data relating to the people of banking age were collected and it was discovered that the ATMs available in the local government were grossly inadequate and unevenly distributed

Keywords: cashless society, ATM, Information and Communication Technology, Automation, Payment Infrastructure, e-payment

1. Introduction

The term "A Cashless Society" refers to two types of societies. The first case refers to a society that operates the trade by barter system as the sole means of payment while the second case emphasizes on a society in which plastic money or any other technology that supports virtual transfer of money for goods purchased or services rendered are the sole modes of payment [1]. This research lays emphasis on the second case. A cashless society is a society in which purchases of goods or services are made by credit card or electronic funds transfer rather than with cash or cheques or other means that involves cash [9]. The Financial systems, all over the world are charged with the responsibility of providing the means through which goods and services could be conveniently paid for by buyers and these means may be by cash, or without cash i.e. through electronic system.

Business activities have been in existence since creation. One peculiar feature of business activities according to [1] is that for any product given up or services rendered, something must be given in return. Any activity becomes business only when something in form of payment is given in return. In the olden days, business activities were conducted through trade by barter system which later paved the way for monetary systems. According to [12]; ‘payment systems refer to the methods of conducting transactions in the economy’ [5]. These systems evolved alongside different forms of money (anything that is generally acceptable in payment for goods or services or in repayment of debts). Money is different from ‘currency’ which is commonly misconstrued as money but is only a type of money. The introduction of money addressed critical challenges inherent in barter economy as money became a medium of exchange (used to pay for goods and services) and served as a unit of account (used as value measure for goods and services)[15]. Also it served as a store of value (used as a repository for purchasing power over time).

The major form of money which was prevalent was commodity money exemplified in the precious metals of ‘Gold and Silver’ and cowries. The heavy weights of these commodities and difficulty of transporting some over long distances pose a serious limitation. This major limitation led to the introduction of paper currency which could as well be converted into coins or definite quantities of precious metals. However, because it was bulky and therefore difficult to transfer large volume of paper, cheques were introduced. Cheque is essentially an instruction from an individual (who owns an account in a bank) to the bank to transfer money from his/her account to another when the cheque is deposited. Though cheques brought about innovation and efficiency of the payment system, it has its draw backs such as delay in processing/clearing and payment. This gave rise to Electronic Payment (e-payment) and subsequently e – money. E –

Money is a form of e – payments, whereby e – payment do not only substitute for cheques but also for cash. The use of debit card, credit card, stored value-card, e – cash, fund transfer, etc. are among several modes of e – money. This culminated in the current “cashless policy drive” across the globe.

The technological breakthrough and advancement in information and communication technology in recent years has led to a surge in the deployment by banks and use by the public of electronic system for effecting payment for goods and services despite resistance from various groups. This bug is gradually catching up with payment of goods and services in Nigeria. In Nigeria, the use of electronic systems for payment for goods and services instead of using physical cash is gradually gaining momentum. This is because the world is in a transitional period; from a paper money based society to a cashless society [1].

According to [16], the formal introduction of cash-less policy was via CBN circular Ref. no COD/DIR/GEN/CIT/05/031 dated 20th April, 2011. (CBN, 2011). The reactions of people to the policy were contained in [5]. This may mean that, not enough had been done to address the genuine concerns of the citizenry about the cash-less economy.

A bank's primary function is to deliver financial services and products to the customers. The success of such an institution depends on closeness to customers, its approach to data management, customer relation management. The most important factor to customers is the closeness and ease with which bank's services can be accessed. Therefore, location convenience is an important factor when customers select a financial institution. A customer may find a bank convenient if it has a branch or an Automated Teller Machine (ATM) near his / her residence or workplace, say within 2 Km. To stay competitive, banks usually attempt to increase convenience

(be as close as possible to customers) by expanding their bank and / or ATM networks. Thus e-banking is a new era of technological revolution. Today, it is all about e-platform, which in a very simple form implies offering financial services through electronic media to various customers irrespective of place, time and distance.

Several scholars have attempted to analyze the cash-less system or e – banking. However, it is obvious that, a comprehensive evaluation of the ATM machines available to sustain the policy of the “Cash-less economy” is yet to be done. This research is therefore tailored to comprehensively take a look into the number of banks and the location of their ATMs in Akure South Local Government, one of the Local Governments in Ondo State to determine the sustainability of the cashless policy by the available banks’ ATMs.

2. Objectives

One of the major requirements for the success of the cashless policy is a means through which people can pay for goods and services without necessarily entering the banking hall or involving physical cash. These means include the use of cards, Internet banking and other electronic means. The most popular and widely embraced among these is the use of ATM. Therefore, the primary objective of this research is to evaluate the quantity of ATMs in Akure township to determine its sufficiency or otherwise for the cashless policy of the Central Bank. Other objectives are to

- a. Determine the total number of ATMs in Akure, their distribution and locations and
- b. Know the number of ATMs owned by each bank

3 Review of Current Literature

This section exhumes and analyses current literature on cashless policy. Discussion centers on evolution of cash-less economy (e-banking) in Nigeria and requirements for a smooth cashless policy, amongst others.

3.1. E-banking in Nigeria

The Central Bank of Nigeria (CBN) is the bank charged with the responsibility of regulating banking activities in order to stimulate growth in the economy. The CBN do formulate policies that will ensure the realization of her objectives as posited by [6], [2] and [1]. According to the report of Technical Committee on e-banking [7], e-banking can be defined as a means whereby banking business is transacted using automated processes and electronic devices such as personal computers, telephones, facsimiles, Internet, card payments and other electronic channels. E-banking is a kind of banking that involves electronic form of money transmission.

[16] stated that, e-banking started in Nigeria in the 1980s but was truncated by the then military government. Though banks and other businesses showed enthusiasm by introducing credit card, debit card, charge card, etc., into the payment platform, e-banking ebbed owing to political and economic crisis of the period. However, e-banking rejuvenated in the late 1990s though tentatively. [14] opined that the Structural Adjustment Programme (SAP) introduced in 1986 made the number of banks grew tremendously from 40 in 1985 to 125 in 1991 and the effect of this was that the new banks introduced a new way of carrying out banking operations. Therefore, Nigeria experienced e banking in November, 1990 when Societe Generate bank launched their first Automated Teller Machine.

3.2. Use of Information and Communication Technology by Banks

[3] enumerated the various ICT being used in the banking industry to include the following Automated Payment Systems that was defined by [11] as a cash dispenser that has a unique 24/7

service facility, that is, the machine unattended to i.e. "stand alone" or "wall mounted" (outside or inside the banking hall) allow customers to transact limited business without referring to any bank staff except in case of problem.

Electronic cards that are made up of credit cards and Debit card, Automated Delivery Channels

On-line banking, Internet banking and Telephone Banking (Tel-Banking)

3.3 Requirements for Smooth Cash-Less Policy

The requirements for a successful implementation of a cashless economy are quite encompassing and vary. According to [14] any effort to implement e-banking, e-payment or cashless economy must necessarily address such basic needs if such efforts are not doomed to fail. These requirements include:

- a. Payment infrastructure
- b. Power and functional telecommunication
- c. Information and Communication Technology (ICT)
- d. Legislation: Legal and regulatory framework
- e. Availability of real data

The list is by no mean exhaustive but suffices it to mean that, the above enumerated requirements are fundamental to the success of e-banking or cashless-banking and therefore be provided or put in place prior to take-off date.

The effectiveness and efficiency in rendering smooth services to the populace and performing these roles, particularly the intermediation between the surplus and deficit units of the economy, depend largely on the level of development of the financial system [9]. Presently, the banking industries operate in a complex and competitive environment that is characterized by changing

conditions and highly unpredictable economic climate. Information Technology (IT) is at the center of this global change curve of e-banking system in Nigeria today [17]. The major players in the money market are the banks and discount houses. The banking industries play the intermediate role of ensuring the mobilization of idle funds from the surplus units to the deficit sector.

Despite the positive impact of technology on society, it has on the other hand led to unintended use in criminal activities like cybercrime. It has therefore become easier to steal from millions of bank account owners using the internet than through conventional bank robbery. Since banking is highly based on trust from its customers, security issues will remain a special concern in the banking industries. Hence, the risk of hackers, denial of service attacks, technological failures, breach of privacy of customer information and opportunities for fraud created by the anonymity of the parties to electronic transactions have to be properly managed [10].

3.4. Merits and Demerits Associated with Cashless Policy.

[8] enumerated the benefits of cashless society. In addition, the following are some of the merits associated with a cashless society.

- i. Cleaner society
- ii. Improved security.
- iii. Easier business transactions.
- iv. Printing of paper money is usually an expensive affair.

The demerits associated with a cashless society as stated in [1] include:

- i. When using cards, the owner is required to give a valid pin number for them to gain access to their account. This feature may turn out to be a disadvantage in cases where the real owner of the card forgets his/her pin number. This will mean that they will not be able to get access to their accounts, at least, until after the bank addresses their issue.
- ii. Credit cards make it easy for people to accumulate credit.
- iii. Lack of privacy.
- iv. Computer hackers can also hack into people's accounts and withdraw funds.

4. Research Method

Research method is understood as all those methods and techniques that are used for conducting a research. Since the object of research is to arrive at a solution for a given problem, the available data and the unknown aspects of the problem have to be related to each other to make a solution feasible. Keeping this in mind and view, methods used in this research fall into these three groups;

- i. Methods which are concerned with the collection of data
- ii. Methods used for establishing relationships between the data and the unknown
- iii. Methods used to evaluate the accuracy of the results obtained

4.1 Data Collection

Data collected for the purpose of this research are data relating to ATMs in Akure and data of people that can legally open and maintain a bank account. These data were physically collected. The data relating to ATM were got by physical counting and this involved physical counting of

all ATMs in Akure and the banks that owned them. The collected data were gathered according to their streets and locations.

The population of people of voting age was collected from the INEC office, Akure. People of voting age are people that are eighteen (18) years and above and they are also the same set of people that are legally allowed to maintain a bank account.

4.2 Result

Table 1 shows the total number of ATMs in Akure metropolis. Table 11 shows the total number of ATMS, the distribution of the machines according to ownership and locations. From the table, 84 ATMs were recorded within the metropolis and are located as follows:

Table 1: location of ATMS

LOCATION	NO OF ATMs
Alagbaka	42
Oyemekun	10
Arakale	6
FUTA	8
Oja Oba	6
Secretariat	1
Oba Adesida	5
Oke-Aro	2
NEPA	2

Chicken Republic	1
GN	1
TOTAL	84

Table 11: Locations of ATMs Owned by Each Bank in Akure as at May 2013

NO	BANK NAMES	TOTAL NO OF ATM	% OF ATM	LOCATION OF BANK ATMs									
				Alagb aka	Oyem ekun	Ara kale	FUTA	Oja Oba	Sec	Oba Ade sida	Oke Aro	NEPA	Chi cken Repu blic
1	ACCESS	3	3.6	3									
2	ASO	1	1.2	1									
3	DIAMOND	1	1.2		1								
4	ECO	4	4.8	3		1							
5	ENTERPRISE	5	6	1				1	2	1			
6	FCMB	3	3.6	2		1							
7	FEDELITY	2	2.4	2									
8	FIRST BANK	16	19.0	7			2	3		2	2		
9	GTB	11	13.1	9			2						
10	KEYSTONE	2	2.4	2									
11	MAINSTREET	1	1.2			1							
12	NPF MICROFINACE	2	2.4									2	

13	SKYE	8	10	2	6									
14	STANBIC IBTC	2	2.4											1
15	STERLING	1	1.2		1									
16	UBA	8	10	6		1	1							
17	UNION	4	4.8	2					1		1			
18	UNITY	2	2.4		1						1			
19	WEMA	4	4.8		1		2				1			
20	ZENITH	4	4.8	2		2								
MOST POPULATED LOCATION WITH ATM				42	10	6	8	6	1	5	2	2		1

4.2.1 Population

Table III below shows the population distribution of people of voting age in the eighteen local government areas of the state. The total population of people of voting age which is the same as people of banking age in Ondo State is one million, three hundred and forty one thousand, three hundred and ninety two (1,341,392). Out of this, two hundred and thirty thousand, four hundred and sixty three (230,463) are in Akure South which basically is Akure township and her surrounding villages. In other words, the people of banking age living in the area of research focus are two hundred and thirty thousand, four hundred and sixty three.

Table III: Population of People of Voting Age Used as Banking Age

LOCAL GOVERNMENT	POPULATION
Akoko North East	56,599
Akoko North West	53,724
Akoko South East	29,901
Akoko South West	74,148
Akure North	49,651
Akure South	230,463
Ese odo	59,499
Idanre	57,264
Ifedore	54,072
Ilaje	104,062
Ile oluji / Oke-Igbo	55,136
Irele	49,782
Odigbo	97,856
Okitipupa	81,658
Ondo East	31,281
Ondo West	130,771
Ose	48,257
Owo	89,268
TOTAL	1,341,392.

4.3 Discussion

In Akure, the only major town in Akure South Local Government with banking facilities has a total number of eighty four (84) ATM machines scattered along the important streets in Akure town-ship. ATMs could only be found in eleven (11) different locations in Akure Township. Out of this number, First Bank has the highest number of machines which is sixteen machines or 19% of ATMs and it is followed by GT with eleven machines which represent 13.1%. The banks with least number of ATMs are Sterling, Diamond, ASO and Sterling with one (1) each or 0.12% each

The ratio of machine to people of banking age is 84:230463 which is 1:2744. In other words, one machine is expected to serve two thousand seven hundred and forty four people. The machines are not evenly distributed and are not commensurate with population pattern. As seen in Table 1, forty two machines were found in Alagbaka area of the town. Alagbaka is a business area that host government and business offices like banks, insurance etc. with few people living close to the area while there are very few or no machines in areas with thick population. No ATM machine is located in the surrounding villages of the Local Government. Succinctly, the machines are not evenly and fairly located.

5. Conclusion

This study shows that about half of the identified ATM machines were located in Akure business area with few people living within the environment while part of the areas that are thickly populated are left with the remaining half of the machine. The study shows further that First Bank has the highest number of ATMs while Aro , Mainstream and Sterling Bank each have one ATM. It was discovered that the number of branches of each of the banks plays a significant role

in the number of ATMs owned by that particular bank. For example, First Bank with the highest number of ATMs has the highest number of branches in Akure and the same goes for all the other banks. The ratio of ATM to people of banking age is 1:2744. This means one machine is expected to serve 2744 people all things being equal. It is therefore not a surprise that most people do walk long distance to access the service of ATM because of the insufficiency of the number of ATMs in the town and uneven distribution of the few ATMs. It can consequently be concluded that the available number of ATMs in Akure cannot sustain the cashless policy of the Government.

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UNDERSTANDING THE CONTRIVE CONFRONT OF 3D VIDEO GAME AUGMENTATION AND CONTRAPTION

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CONCEPTUAL

This document chiefly discusses the 3D game contraption and a variety of skill implicated in the advance of 3D games. It parleys the devise of 3D game engine and different genus of 3D games. The further spotlight is on the diverse skill and the outfit vital in beginning a 3D game. The computer game manufacturing has embarked on an abrading merchandise and expertise from its preliminary pursuit heredity to a numeral of "staid" engineering. Games are mortal espoused for protection, linctuses, structural design, edification, and regime appliances. All of these diligences are now supplied by a conventional folks of tropes that classically do not employ games or the expertise that support them. The quick augmentation in the authority of game technologies and the rising communal receipt of this knowledge has fashioned an atmosphere in which these are relocating other production explicitly computer hardware and software group. This paper lays brash a game bang that recognizes the precise services that induce manufacturers to espouse gaming skills for their mainstay commodities and provisions.

FACTION: 3D Game Contraption, Genus of 3D video game, 3D Game Augmentation

PROLOGUE

3D tools have been well urbanized and this in sequence has become more residential than before. 3D knowledge has been worn in numerous pastures in our day by day life. Though, to get in touch with the end user and consultation, this 3D technology covets to be flaunted. Usually, there are 4 kinds of 3D display, specifically stereoscopic, improved and implicit reality, primary image and holographic exhibit. Figure 1 will parade a straight forward 3D technology demonstrate. Traditionally, 3D tools were industrialized predestine on 2D graphics. Near the beginning of 90's

2D graphic expertise gained its reputation. Subsequently, 3D technology became established and underway to be the mercantile. Quite a lot of ground had been attained by preceding 3D technology. 3D technology followed by the barnacled over into 3D stereoscopic that being extremely second-hand most recently. Later, researchers strived to come across a different approach to present 3D technology, and afterwards augmented/implicit reality emerged. Only just, an augmented and implicit reality has achieved assured echelon to carry them from the research lab into valid orb. The core technology has been middle-aged to be practical in a number of arenas of human life, such as pursuit, edification and others. The primary image is preliminary to extend as well nowadays. It ascends to trounce some difficulty emerged from 3D stereoscopic tools, such as parallax dilemma. This technology is tranquil in procedure to discover their ripeness in the research lab. And at last, the most perfect 3D technology display is holographic exhibit. The preceding 3D display though is still enclosed by the monitor. It is just the illusion of 3D display behind the screen. Holographic display will display the 3D object in the free space and can interact directly with the user.



Figure 1: 3D Game modelers tend to work in Video Gaming

FICTION ANALYSIS

Jae-Hwan Bae1 and Ae-Hyun Kim et al. [1] Suggested that in the game industry, core platforms emerged for each time and recently it has changed to a multi-platform game and being renovated. Multi-platforms are Emerging as an essential strategy for a radical innovation to launch new types of products and maximization of profits. Especially, as SNS Apps such as KAKAO TLAK or LINE have become prevalent, games linked with theses Apps have achieved huge popularity. Actually, looking at the Android Market, over half of the top 100 games are linked with KAKAO TLAK. It is a big advantage and success factor that the games linked to the social network service are maintained while forming social relations. Although various kinds of engines and tools are used in SNG game production, among them, especially the Unity 3D engine through which high-quality games can be created easier and faster, is used in current development by many companies. In particular, it provides many kinds of functions for itself and can produce almost all forms of games. The 3D Unity, a game engine, has a high potential in the efficiency of the development process of games. And the increasing availability of it proves its possibility. The 'Endless Tower' created using the 3D Unity game engine is expected to sufficiently play a role in modern life game which give joy for a while at the spare time in daily life, through the social functions, easy control and speedy proceeding, and exhibit the potential for developing easier multi-platform games. Abdul Aleem Shaikh, Karm Raj et al. [2] Made an attempt to bring platform games in 3D. It brings a nostalgic experience to the users. The implementation of the techniques was illustrated through the Android Mobile Game and

described in detail with the complete code and Gaming Interface. Therefore, the project results in a successful definition of the instructions for the development techniques and a functional Android Base Game Application. Javier Torrente, Pablo Moreno-Ge et al. [3] Proposed an approach that does not force educational institutions to install any specific software, as it takes advantage of the existing LMS infrastructure. In addition, their approach promotes reusability of contents, protecting the investment against possible LMS replacements. On the other hand, the educational video games produced can be stored in public LO repositories to promote the exchange of contents. Thus, they had inherited all the benefits of the LO model. Next steps in the project are to test the educational outcome of using games and simulations in an actual University course. They are currently collaborating with researchers from the Complutense School of Medicine to create educational games to support the practical exercises performed. The games will be delivered to the students through the Complutense's e-Learning environment (Virtual Campus), integrated with the rest of the online content that supports 3D technology. K. Subhash Babu and R. Maruthi et al. [4] Gave an outline of the phases involved in the game development process and briefly discussed some of the tools for designing and coding games. The suggested framework and the tools that make the development process systematic and efficient. The game designers and developers can be benefited by this and as they can proceed their game development process without worrying about any defects and shortcomings. Sadaf Sajjad, Sajjad Mohsin et al. [5] Concluded that while 3D designing or digitizing 2D sketched character, the basic principles and elements of design play their part. Basic shapes, colors and textures are combined to produce the proposed visual effect. 3D designing requires designing software that should be user-friendly to help the designer or a modeler to visually present the idea. If the designing is meant to be utilized in other software for developing any product (game, interactive environment, learning procedure), then software compatibility is kept focused. This is good for smooth designing progression in order to avoid problems that may counter in further developmental procedure.

Aswin Indraprastha, Michihiko Shinozaki et al. [6] Made significant improvement of CAD data compatibility in Unity3D as it can natively read most CAD file types. Furthermore, seamless integration between a game engine and CAD applications makes file synchronization possible. They experienced that .obj file format is the most effective format to be exported to Unity for meshes as .fbx to animation. For the interaction mechanism they created scripts and developed basic interaction system that engages users within the virtual environment. From one side of the view, Unity3D JavaScript-based language gives freedom to create an interaction system based on own preference and ideas. Some of 3D navigation systems that were created are learned from other applications such as Google Earth, Adobe 3D PDF, Corona VRML player and others. Object oriented programming language also gives an advantage in the way that any interaction method came from the game object behavior and it responds to user interaction. The script-based interactions also open possibility to create an interaction system that bounds external data into a game object. For example, they bound external data of text, image, and video into game interaction. Amit A. Kadu, Ashlesha Nagdive et al. [7] Concluded that creating a simple enemy, it don't have the intelligence but one has to develop a competitor enemy for that they applied AI. In simple game player fires at the enemy and it doesn't show any intelligence. Thus, they tried to use expert-based systems and simple finite state machines to show the illusion of a somewhat intelligent opponent. Not only does the computer agent has to play in an intelligent manner, but it also needs to be able to learn as the game progresses. Robert Spears, Cary Rivet et al. [8] Designed an ULL Introductory Game Engine to achieve a reasonable balance between the two goals. It provides its users with a variety of tools and a strong foundation to expand upon, while still making available all of the engine's components. The group projects constructed in 2012 edition illustrate UIGE's strength as an engine and teaching device. The games created where some of the best to come out of the route, and scholars praised the complexity UIGE had over Game Maker. Chung-Ho Su and Ching-Hsue Cheng et al. [9] Aimed at investigating how game-based learning strategy affects student's motivation and learning achievement in the software engineering curriculum. To enhance

software engineering learning, a 3D game-based learning system has been developed and evaluated to explore the students' motivation, satisfaction and learning achievement, it effectively helps students to enhance learning activities based on ARCS learning model. The results show that learning motivations of scholars have significant impact on learning, achievement, and learning achievements with game-based learning is better than those who use traditional Face-to-face teaching. Therefore, re-checked each questionnaire item; their paper finds that the game-based learning challenging and attractiveness can lead to learners' curiosity and immersed in a learning activity. Meanwhile, nearly 80% scholars were satisfied and 83% scholars are confident in for the curriculum learning after use the game-based learning system. Jan Wolter et al. [10] Described the process of specifying generic depictions for 3D visual languages with the generator system DEViL3D. For such purpose DEViL3D provides the editor, which allows the language designer to specify generic depictions. This editor was also generated with DEViL3D in a bootstrapping approach. Hence, the Interaction and navigation tasks are available in all editors generated with DEViL3D. For specifying generic depictions, the possibility to define containers that can embed nested constructs is particularly important. They have presented an algorithm that stretches the containers when they're nested elements need more room. The generic depictions editor is able to specify depictions for a wide range of 3D languages covering languages as Petri Nets or molecular models with rather simple visual representations, but also languages, which consist of real-world objects that have more advanced visual representation as shown in Figure 2.



Figure 2: 3D Game characters centered on characters from the Classical Indian Epic

Francisco Moran, Marius Preda et al. [11] Concluded that Today's multiplayer 4D games will often rely on dedicated/proprietary technological solutions for their servers (e.g., massively parallel, brute-force grid computing), and scale down content a priori, according to the bandwidth or rendering power of the "weakest" node in the infrastructure. The OLGA consortium opted for a completely different paradigm: thanks to scalable coding of the 3D geometry, texture, and animation data, gaming content is automatically adapted to heterogeneous platforms and networks, and the processing load distributed among the resources available in P2P architecture. Indeed, OLGA's 4D content is not stored locally on one single server or local storage medium (e.g., DVD), but is rather distributed over a multitude of servers spread all over the network with adequate load-balancing and fault-tolerance policies, and possibly hosted at the most powerful PCs of the players themselves. Fan Zhang, David Kaufman et al. [12] Review has identified the potential benefits of implementing video games in the context of CS education by reviewing 30 articles published from 2003 to 2012. The most distinctive benefit identified in the articles is promoting students' motivation to participate in the learning process, especially in learning programming. Quite a lot of work has been done in the area of teaching programming by completing the game-

oriented programming assignments. Four implementation strategies for using video games as educational tools in CS education are: (a) using games to motivate students, (b) making games to teach CS topics, (c) using games as environments to teach CS topics, and (d) using games as examples to teach CS topics. Finally, a set of practices is presented for using games as educational tools. Current empirical studies present a positive picture; they show some educational effectiveness of video games using the art service as shown in Figure 3.



Figure 3: 3D Game Characters Design using Art Services

Panagiotis Petridis¹, Ian Dunwell et al. [13] Illustrated that the creation of a serious game is a complex engineering project that requires technical expertise, as well as a careful balance of game design principles with instructional content. Similarly, the development of the generic engines which underpin serious and leisure games is a complicated process that requires time, resources and teamwork. As serious games become more complex, so do the engineering challenges that arise during the development of the game. Hence, the early-stage selection of the optimal engine for development is crucial. They presented a selection framework, allowing the developer to select the ideal engine based on the technical requirements of the serious game. This is the first framework for serious game engine selection currently proposed and tested, and is intended as a starting point for ongoing benchmarking and metrics for supporting the serious game engine selection. However, whilst our framework relates overarching technical requirements to a range of modern engines, more research, testing and validation must still be done to relate learning requirements and instructional design principles to these technical features. Ultimately, the design and implementation of effective serious games must be grounded in pedagogy, as well as technology, and therefore future work should address the many issues surrounding the equation of learning requirements to these identified technical features. Towards this end, future studies will focus upon the analysis of the impact of the various engines and their functionalities on target learner groups. Xiao Cui and Hao Shi et al. [14] Systematically reviewed several popular A*-based algorithms and techniques according to the optimization of A*. It shows a clearly relational map between A* algorithm and its variants. The core of the path finding algorithm is only a small piece of the puzzle in game AI. The most challenge is how to use the algorithm to solve tricky problems. A* algorithm is the most popular algorithm in path finding. It is hard-pressed to find a better algorithm since A* is provably optimal. A lot of effort has been put into speeding it up by optimizing it from different perspectives. The ways to improve the performance of A* search, include optimizing the underlying search space, reducing the memory usage, improving heuristic functions and introducing new data structures. A potential research is to continue optimizing A* algorithm from these perspectives or to combine multiple optimization techniques into one single solution. Another way to make some contribution to the game AI community is to apply these techniques described above to the real computer games because

not all of the techniques described have been widely used in the current game industry. The reason why they are reviewed in this paper is that they are the hottest topics in the academic domain of path finding and many researchers are struggling to bring them into real games. It is expected that this research help game industry has a basic understanding about the future research direction in path finding. Andri Ioannidou, Alexander Repenning et al. [15] Suggested that the preliminary experiences and findings with Scalable Game Design, low-threshold/high-ceiling framework supporting skills beyond programming, ranging from theoretical design skills to concrete development skills, lead them to believe that it can establish IT fluency and broaden participation in computer science with game design activities. The results from their study described herein indicate that it is educationally effective to use AgentCubes as a low-threshold game design environment featuring Incremental 3D for teaching IT skills to middle school students. The AgentCubes instructional sequence did result in opportunities to promote student fluency and the troubleshooting scenarios designed to be used with AgentCubes can be used to document student IT fluency using Adobe Digital Painting as shown in Figure 4.



Figure 4: 3D Game Characters Design using Adobe Photoshop Digital Painting

Alan Amory and Robert Seagram et al. [16] Explained that the development of a number of models to explore the relationships between educational theory and game design provides developers with a conceptual and practical framework that can support the development process. Also, well-crafted games appear to require appropriate puzzles integrated into strong storylines where graphics, sounds and technology are used to create an entertainment medium that could also champion learning objectives. The GAM proved to be an efficient, well conceptualized and supportive model that enabled the design team to work together, despite differing areas of expertise and culture, to construct a coherent, exciting and appropriate storyline for an educational adventure computer game. Debbe Thompson, Tom Baranowski et al. [17] Proposed that DIAB is an entertaining, but serious, theoretically grounded video game designed to reduce risk for Type 2 diabetes and obesity among youth. Emerging evidence suggests theoretically based serious video games can be effective at achieving change in both diet and physical activity. Little is known, however, about the processes and mechanisms through which behavior change occurs in a serious video game. This article elucidates the design of one such video game. It also describes how the entertainment and behavior change experts combined their talents to create an entertaining, theoretically grounded serious video game. Future work needs to explore how to best incorporate debriefing into serious video games designed to change health behavior. A.T. Chamillard et al. [18] Described a freshman-level course in which students create 2D and 3D games using drag-and-drop tools. The intent was to make game development activities available to incoming freshmen without programming skills; most students do very well on the game assignments using the game development tools. They have also taught the majority of the course content to a group of homeschooled

students ranging in age from 12 to 16; those students were also able to successfully complete the game development activities with no programming experience. Specifically, those policies prohibit students from playing games on the lab computers. This was clearly an inappropriate policy for students in this course, since they would essentially be required to create their games without being allowed to test them. Monika Sarve, Deepak Khatri et al. [19] Studied the features of XNA in alliance with C#. They have observed how it proves to be an excellent framework and how it can be used to develop a 3D shooter game. They have also analyzed the great work done by various animation software's such as MAYA and how these software's offer intuitive UIs that are easy to learn and navigate, making the process of creating 3D art as manageable as it could use ZBrush and 3ds Max in creating imaginary species as shown in Figure 5.



Figure 5: 3D Game Monster Insect Creation using ZBrush and 3ds Max

CESSATION

For any thespian, how the game materializes, senses and theatre are of the supreme significance. In the meantime, for the game stylist and programmer, the majority of importance in a cassette game is the game machine. The game machine is principally an executable software relevance that affords a milieu for the maturity and check run of game sense, and or the amalgamation of analogous game sculpture, to eventually fabricate a playable game. With the spiky enhancement of graphics in the anon duration, a newfangled confront is to fashion improved crossing point to intensify the familiarity of game dramatics personae. The main composite type of game improvement machine is the 3D engine. In this scenario, it is refined that an aerodynamic alliance amid scholars of connected restraint forever exert as a very influential mechanism as settled beneath;

- (i) Lucidly incident the involvement of the diverse restraints implicated in the expansion of a video game.
- (ii) Gain knowledge of realizing exertion in such interdisciplinary squad.
- (iii) Attain a rebuff twaddle outlook on the game trade.
- (iv) Augment the wakefulness of the substance of games in contemporary civilization.
- (v) Games are being, and have forever been, all about enjoyment; tranquil, it is astonishing that reaching scholars in the pose of building games can be still more amusing.

ALLUSION

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MEMOIRS



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TYPE2 FUZZY SOFT COMPUTING TECHNIQUE FOR IMAGE ENHANCEMENT

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Abstract:

The standard purpose of Image enhancement is to process an image so that outcome is more appropriate than original image for definite application. The fuzzy logic is one of the soft computing techniques to enhance the images by eliminating uncertainty. In this paper efficient type2 fuzzy logic technique is used to get better quality image. This method consists of two steps. In the First step fisher criterion function is useful to generate type1 fuzzy membership value. In the second step based on type1 membership value fuzzy rules are derived to enhance the image. The type2 fuzzy method is compared with type1 fuzzy. The table values and graphs prove that the proposed method gives better results compared with fuzzy type1 method.

Key words: fisher criterion, fuzzy type1, fuzzy type2, membership function and soft computing.

1. Introduction:

Image enhancement is fundamentally improving the interpretability or perception of information in images for human viewers and providing 'better' input for other automated image processing methods. The primary objective of image enhancement is to modify attributes of an image to make it more suitable for a given task and an exact observer. Throughout this process, one or more attribute values of the image are customized. The selection of attribute values and the technique they are modified are specific to a known job. Furthermore, the observer-specific factor values, such as the human being illustration system and the observer's understanding, will bring in a immense deal of subjectivity into the choice of image enhancement methods. But no existing

technique that can enhance a digital image without spoiling features. In [1], proposed algorithm based on contrast measure within the discrete cosine transform domain for image enhancement. The proposed algorithm is shown better result for low contrasted images. However it fails to retain significant characteristics. In [2], this paper mainly focused on spatial domain methods which are histogram processing and point processing methods. But the author is not given any details regarding the computational cost of enhancement algorithms which play an important role for to choose an algorithm for real applications. In [3], the Mehtre method with High-Pass Filtering, Histogram Equalization and Block Filtering used for enhancing the finger print image. And the new Mehtre technique gives better performance compare to existing Mehtre method. In [4], by using aura alteration, the enhancement is applied on ultra sound images to predict the diseases of human body. It is not applicable to other medical images. In [5], this paper used an erosion enhancement technique by using quality parameters like peak signal to noise ratio (PSNR) and mean square error (MSE) to enhance the gas burner images. This paper gives better results when PSNR is high and MSE with low value. In [6], fuzzy logic and Artificial Bee Colony optimization method improve the quality of the images. This approach provides better performance than Ant Colony Optimization method. In [7], this paper used filtering and Histogram Equalization, gray scale manipulation and fast Fourier transform for enhancing the thermal image. In [8], genetic algorithm is a soft computing technique which is used for enhancing and segmenting the image. In [9], the fingerprint images, colour images and medical images are enhanced by using fuzzy logic approach. This paper not enhanced the video type images. In [10], this paper presents fuzzy gray scale enhancement method for enhancing the image. This approach is good for preserving and smoothing the edge. In [11], by using Dominant Brightness and Adaptive Intensity Transformation, the image enhancement is performed for low contrasted satellite images. The proposed technique is useful to avoid the over enhancement compare to existing techniques. In [12], it presents adaptive thresholding and contrast stretching for enhancing the MRI knee images, which is used for medical applications. In preprocessing an image is processed for

removing noise, automatic edge detection, edge or boundary enhancement, automatic contrast adjustment and segmentation. This method is not applicable for enhancing the damaged images when multiple noises are applied to an image. In [13], an Adaptive Contrast Enhancement Based on modified Sigmoid Function (ACEBSF) algorithm is used in various applications where images suffer from various contrast inconveniences and it gives high speed, good performance and less CPU time for processing the natural images. In [14], the author presents fuzzy association rule mining for enhancing the mammogram image. This method has proven better for enhancing and it uses less processing time to enhance the image. In [15], based on novel algorithm with statistical operations and with neighbourhood computation, the image enhancement has been performed. This algorithm is good for preventing from side effects and it preserves the consistency and brightness of the image. In [16], this paper presents Contrast Limited Adaptive Histogram Equalization (CLAHE) method for image enhancement and class 3 fuzzy C means clustering method used for image segmenting. The proposed method is superior for improving the threshold value at lesser CPU processing cost. It is not used for different objective functions like FCM (Fuzzy C-Mean) and C-mean. In [17], the proposed technique used artificial intelligence for image enhancement and gives better results compare to spatial and frequency domain methods. It is not applicable for optimized enhancement. This method is not good at computation time and faster response. In [18], this paper presents image enhancement based on fuzzy logic with histogram modifications for all colour images and gray scale images. In [19], based on fuzzy type2 and morphological gradient method, the image edge detection is performed. But this method only used heights and approximations for defuzzification.

2. Fuzzy Type 1:

In a gray scale image the morphological gradient is defined as the difference between intensity values of two neighbouring pixels. It belongs to structural element. ∇ Is a gradient operator and is a vector. ∇ is taken as

$$\nabla = i \frac{\partial}{\partial x} + j \frac{\partial}{\partial y} \quad (1)$$

and $g_c(x, y)$ is a continuous space image is defined by

$$\nabla g_c(x, y) = \frac{\partial g_c(x, y)}{\partial x} i + \frac{\partial g_c(x, y)}{\partial y} j \quad (2)$$

Where, i and j are the unit vectors along x and y directions respectively.
Its magnitude at point (x_0, y_0) is $|\nabla g_c(x_0, y_0)|$, measures the maximum rate of change in the intensity. The local maxima is

$$|\nabla g_c(x, y)| = \sqrt{\left(\frac{\partial g_c(x, y)}{\partial x}\right)^2 + \left(\frac{\partial g_c(x, y)}{\partial y}\right)^2} \quad (3)$$

In this paper we use E_i instead of $\nabla g_c(x, y)$, apply 3X3 matrix in **fig (1)**, and calculate the coefficients of Z_i with (4) and the directions of the edge mentioned in figure (2)

$$\begin{aligned} E1 &= \sqrt{(z_5 - z_2)^2 + (z_5 - z_8)^2} \\ E2 &= \sqrt{(z_5 - z_4)^2 + (z_5 - z_6)^2} \\ E3 &= \sqrt{(z_5 - z_1)^2 + (z_5 - z_9)^2} \\ E4 &= \sqrt{(z_5 - z_3)^2 + (z_5 - z_7)^2} \end{aligned} \quad (4)$$

$$Sum = E1 + E2 + E3 + E4 \quad (5)$$

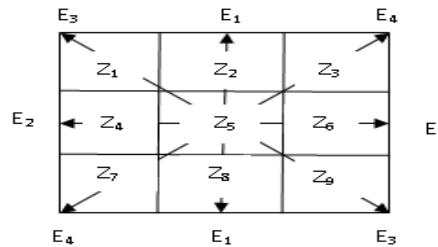


Fig1: Matrix of 3X3 representing the coefficients Z_i and the edge directions E_i .

$$low_i = \min(E_i) \quad (6)$$

$$high_i = \max(E_i) \quad (7)$$

$$medium_i = low_i + (high_i - low_i)/2 \quad (8)$$

$$\sigma_i = \text{high}_i / 5 \quad (9)$$

$$\text{mean}_a = \text{high}_i \quad (10)$$

$$\text{mean}_b = \text{mean}_a + (\text{mean}_a * \text{FOU}), \text{ where FOU is in } (0,1) \quad (11)$$

$$\text{Avg mean (m)} = \frac{\text{mean}_a + \text{mean}_b}{2} \quad (12)$$

$$\text{Var}(\sigma_v) = \frac{\delta}{2\sqrt{6}} + \varepsilon \quad (13)$$

$$Q_k = \text{gauss}(k, [\sigma_k, \text{mean}_k]) = \exp \left[-\frac{1}{2} \left(\frac{k - \text{mean}_k}{\sigma_k} \right)^2 \right] \quad (14)$$

3. Proposed System:

The proposed fuzzy type2 is used here to enhance the images efficiently for to identify the real objects for the processing of data. Two coordinates of the 2-D histogram expressed as L(i) and X(j) respectively, the mean and variance of the 2-D histogram of Fisher criterion can be given by the following equations

$$\mu_k = (\mu_k^i, \mu_k^j), k = 0,1 \quad (15)$$

$$\sigma_k^2 = (\sigma_{ki}^2, \sigma_{kj}^2), k = 0,1 \quad (16)$$

Where mean is calculated as follows

$$\mu_0^i = \int_{i=0}^s \frac{i * L(i)}{L(i)} di \quad (17)$$

$$\mu_0^j = \int_{j=0}^t \frac{j * X(j)}{X(j)} dj \quad (18)$$

$$\mu_1^i = \int_{i=s+1}^L \frac{i * L(i)}{L(i)} di \quad (19)$$

$$\mu_1^j = \int_{j=t+1}^L \frac{j * X(j)}{X(j)} dj \quad (20)$$

and the variance is considered as follows

$$\sigma_{oi}^2 = \int_{i=0}^s (i - \mu_0^i)^2 * L(i) di \quad (21)$$

$$\sigma_{oj}^2 = \int_{j=0}^t (j - \mu_0^j)^2 * X(j) dj \quad (22)$$

$$\sigma_{li}^2 = \int_{i=s+1}^L (i - \mu_1^i)^2 * L(i) di \quad (23)$$

$$\sigma_{lj}^2 = \int_{j=t+1}^L (j - \mu_1^j)^2 * X(j) dj \quad (24)$$

$$L(i) = \int_{j=0}^{L-1} \int_{i=0}^{L-1} N(i, j) \quad (25)$$

$$X(j) = \int_{i=0}^{L-1} \int_{j=0}^{L-1} N(i, j) \quad (26)$$

Thus 2-D fisher criterion function is defined as below

$$D = \left(\left[\frac{\mu_0^i + \mu_0^j}{2} \right] - \left[\frac{\mu_1^i + \mu_1^j}{2} \right] \right) \quad (27)$$

$$J_F(s, t) = \frac{D * D^T}{\sigma_{oi}^2 + \sigma_{oj}^2 + \sigma_{li}^2 + \sigma_{lj}^2} \quad (28)$$

In fuzzy systems for modelling the process, we consider the three rules that depict the previous relationship between the image gradients. The fuzzy rules are

- i) If (E1 is H) or (E2 is H) or (E3 is H) or (E4 is H) then S is EDGE, where H is HIGH
- ii) If (E1 is M) or (E2 is M) or (E3 is M) or (E4 is M) then S is EDGE, where M is MEDIUM
- iii) If (E1 is L) and (E2 is L) and (E3 is L) and (E4 is L) then S is No EDGE, where L is LOW

4. Quality parameters

4.1 Mean: mean is used to find the average gray levels of the image. It is considered as:

$$mean(\mu) = \frac{1}{RS} \sum_{x=1}^R \sum_{y=1}^S f(x, y)$$

Where R and S are width and height of the image and $f(x, y)$ is gray value.

4.2 Standard deviation: the standard deviation of gray level image is calculated as follows

$$st(\sigma) = \sqrt{\frac{1}{RS} \sum_{x=1}^R \sum_{y=1}^S (f(x, y) - \mu)^2}$$

Where R, S are the width and height of the image, μ is mean of the image, $f(x, y)$ is gray level value of the image, $St(\sigma)$ is standard deviation.

4.3 Jaccard Index: jaccard index is a statistic used for comparing the similarity and diversity of sample sets. It is calculated as:

$$Jac(P, Q) = \frac{|P \cap Q|}{|P \cup Q|}$$

Where P and Q are both empty, we define $Jac(P, Q) = 1$ and $0 \leq Jac(P, Q) \leq 1$.

5. Experimental Results:

In this paper, the fuzzy type2 method is used for image enhancement. The quality parameters mean, standard deviation and jaccard, are useful for finding the performance of the fuzzy type1 and type2 with skull, dog, signature, doll, mirchi, text, letter and blood cells images and the table values are shown in **fig (2)**. The **fig (3)** shows the comparison of fuzzy type1 and type2 and proves that the type2 is better than type1. The graphs are shown in **fig (4)** to **fig (7)**.

Image	Type1 Mean	Type2 Mean	Image	Type1 Std	Type2 Std	Image	Type1 JC	Type2 JC
Skull	0.4434	0.4068	Skull	0.1167	0.1591	Skull	0.5566	0.5932
Dog	0.4168	0.3924	Dog	0.0985	0.0641	Dog	0.5832	0.6076
Signature	0.362	0.3236	Signature	0.0892	0.0796	Signature	0.638	0.6764
Doll	0.2165	0.2146	Doll	0.1984	0.1407	Doll	0.7835	0.8854
Mirchi	0.2183	0.2153	Mirchi	0.1567	0.1188	Mirchi	0.7817	0.8847
Text	0.264	0.223	Text	0.0939	0.1364	Text	0.736	0.777
Letter	0.3166	0.2151	Letter	0.0849	0.0627	Letter	0.6834	0.9849
Blood cells	0.3063	0.2304	Blood cells	0.0986	0.0589	Blood cells	0.6967	0.8696

Fig 2: Type1 and Type 2 mean, Standard deviation and Jaccard values

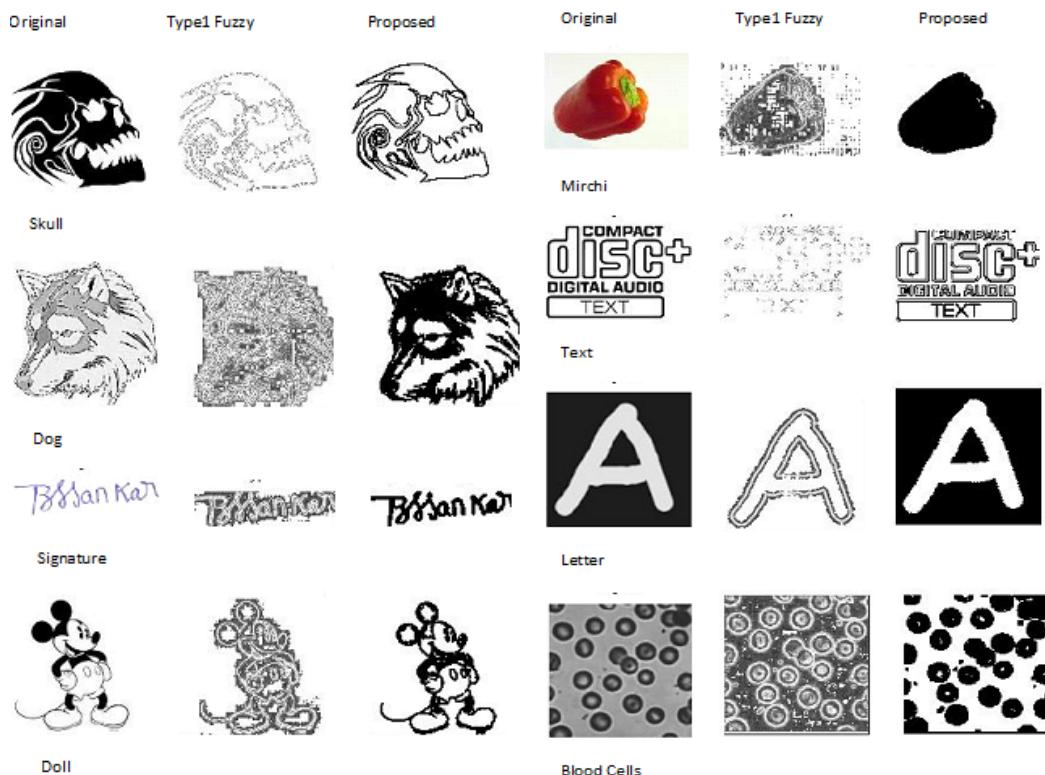


Fig 3: Comparisons of Fuzzy Type 1 and Type 2

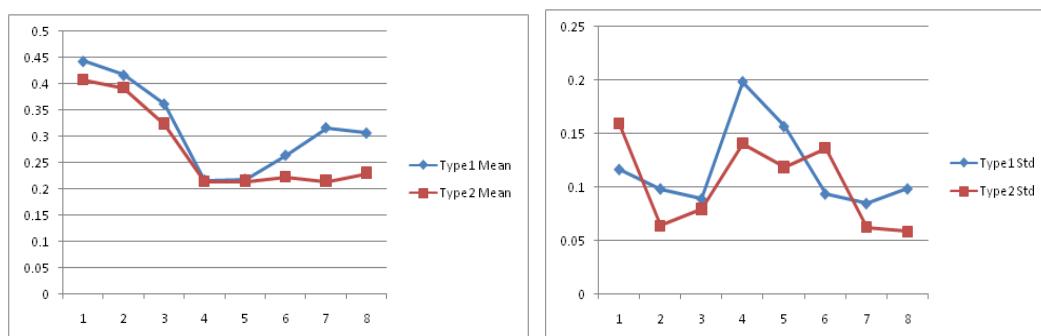


Fig 4:Fuzzy Type 1 & Type 2 mean

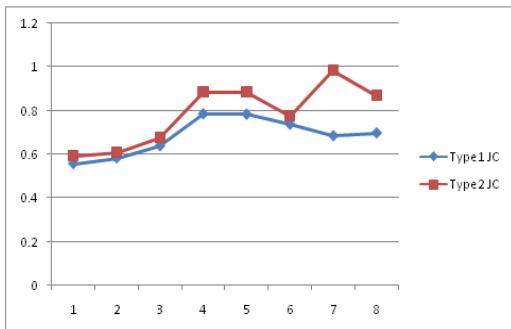


Fig 5: Fuzzy Type 1 & Type 2 Standard deviation

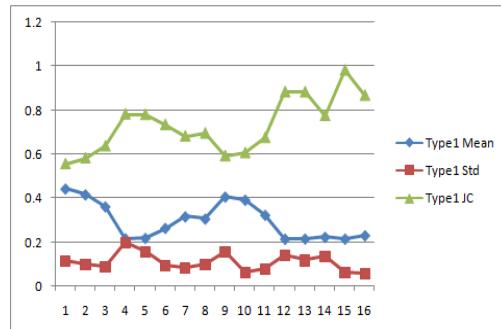


Fig 6: Fuzzy Type 1 & Type 2 JC

Fig 7: Comparison of Fuzzy Type 1 & Type 2 values

6. Conclusion:

In this paper we performed the image enhancement by using fuzzy type2 method. The fuzzy type1 and type2 are compared with skull, dog, signature, mirchi, text, letter and blood cells images. Here both the methods are compared with quality parameters mean, standard deviation and jaccard functions. In most of the test cases the proposed method gives better result. But the proposed method not gives better result for document type images. In future scope we develop the proposed method for enhancing all types of images.

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Design of an Automated River Water Level Monitoring System by using Global System for Mobile Communications

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Abstract – This paper proposes a wireless solution, based on Global System for Mobile Communication (GSM) network for the monitoring and controlling of the river water level parameter. One of the advantages of the system is that it can be used for monitoring decrement of water level in the rivers and water level rising in case of flooding. The system at a certain interval continuously sends river water level measurements to the concerned authority with water environmental flow management. But once the river water reaches the critical level either by decreasing or flooding, an alarm will be sent via GSM network to the personal in charge, furthermore, the proposed system allows on-line configurations of the system equipment's at the field. This system, uses open access platform Arduino as main controller, ultrasonic sensing equipment and web infrastructure that allows remote access of information from any place of the country.

Keywords: GSM, Open Access Platform Arduino and Ultrasonic Sensor.

1. INTRODUCTION

Tanzanian national water policies and laws call for protection of a reserve in all aquatic ecosystems[1],[2]. The reserve is generally defined as the minimum water levels that must be left in the system in order to sustain, as a first priority, basic human needs and aquatic ecosystems. These policies and laws recognize that healthy river systems require minimum flow levels to be sustained, but that rivers in turn provide a multitude of ecosystem services for communities, including clean drinking water, food, building materials, and religious and cultural roles.

In some cases water level monitoring is done by an individual who visits each river and takes water level samples using a method known as The Building Block Methodology (BBM). Often these rivers are in places with difficult access making the procedure difficult, expensive and results unreliable[3]. Obtaining water level measurements of the rivers manually, analysing and

making overall decisions on water control and management if needed, it is a slow and expensive task which in turn doesn't guarantee reliable results. Sampling results obtained with a big delay doesn't let doing corrections in time. Measurements of water levels in the main channels of rivers, upland tributaries and floodplain lakes are necessary for understanding flooding hazards, methane production, sediment transport and nutrient exchange. But most remote river basins have only a few gauging stations and these tend to be restricted to large river channels. Although radar remote sensing techniques using interferometric phase measurements have the potential to greatly improve spatial sampling. The technique makes use of the fact that flooded forests and floodplain lakes with emergent shrubs permit radar double-bounce returns from water and vegetation surfaces[4],[5]; thus allowing coherence to be maintained. With additional data from future satellite missions, the technique described here should provide direct observations important for understanding flood dynamics and hydrologic exchange between rivers and flood plains[6]. Space borne radar interferometric delay measurements are used to infer high-resolution maps of integrated atmospheric water vapour, which can be readily related to meteorological phenomena. Maps of the water vapour distribution associated with a precipitating cloud, partly precipitating conventional methods, and suggest that such radar observations can be used for forecasting and to study atmospheric dynamics[7-9].

However the limitations and high cost on using radar interferometry through satellite enforces researchers to come up with other different technological ways through information systems that allow remote monitoring of water level[10]. These systems are real time remote sensing of the water level parameter which provide information that enables effective monitoring and control of water usage at low cost[11-14]. Water level information is periodically transmitted to the head office and stored in a database. The systems may be equipped with the decision support algorithms and applied to identifying and controlling changes in each

river. The consultation and administration of the data is carried out through the Global System for Mobile Communications (GSM) network which is available almost all over the country. The information system allows real time monitoring and notice about some typical situations. With real time information, it is possible to prevent the supply of water while the level is at a critical point[15-19].

2. REVIEW OF THE STATE OF THE ART

Currently in our country all rivers use historical gauging stations to determine water levels of low and high flows, the measurement taken through these stations guide the specialists in prescribing reserve flow recommendations within the natural range of the river's hydrological regime and extrapolate the reserve flow recommendations across the natural shape of the river's hydrograph[20],[21]. Collecting water level measurements from these gauging stations is time consuming and expensive task which in turn doesn't assure reliable results. The designed systems by researchers facilitate human in collecting water level data that can be performed in real-time. The ultrasonic sensor is used as non-contact sensors for detecting water level by measuring distance between sensor and water surfaces[22],[23]. The sensor connected to the controller unit which reads the variable water level values and employing the Short Message Service (SMS) standard to send it by the cellular phone network. This is also accomplished by means of a GSM Modem which transmits it to the database of the concerned authority[24-26]. Most people rely on rivers not only for water, but also for a wide variety of ecosystem services, including food, medicinal herbs, building materials, and religious practices. The capacity of a river to meet these varying demands depends upon having a sufficient amount of water within its channel over time at levels that mimic the river's normal ebbs and flows. Thus, both components of the reserve such as basic human need and sustainable aquatic ecosystems benefit people directly. As human populations increase, there is increased demand for riverine resources by sometimes conflicting interests. People must decide which resources are critical enough to their livelihood that they are worth protecting. Working with local communities is the best way to determine what primary ecosystem services a river provides, to what degree those services depend on certain flow levels, and

how those services may have changed over time. The primary objectives of this paper are to 1) describe adequate provision of human needs by water resources annually and accessibility of water for domestic purposes. 2) Determine the current systems and proposed system suitability from a theoretical point of view as well as practical reasons for using it. 3) Describe the experimental design and how it accomplished the threat to the river water level.

3. PROPOSED SYSTEM OVERVIEW

The designed system use commercial hardware to allow the acquisition of river water levels from ultrasonic sensor which placed near to the river water surface. After the data acquisition, with a defined sampling period, this data is processed by Arduino and sent by GSM Modem to the database of the head office station , concerned with water environmental flow management. The responsibility for the water resource maintenance is informed every time when the minimum critical water level reached. There are several ways to get information about critical water level status. The first is from a message sent to a mobile phone, through an SMS using GSM technology, and the second through a personal in charge who can also get data in real-time by polling the desire remote system as can be seen in the block diagram in Fig. 1.

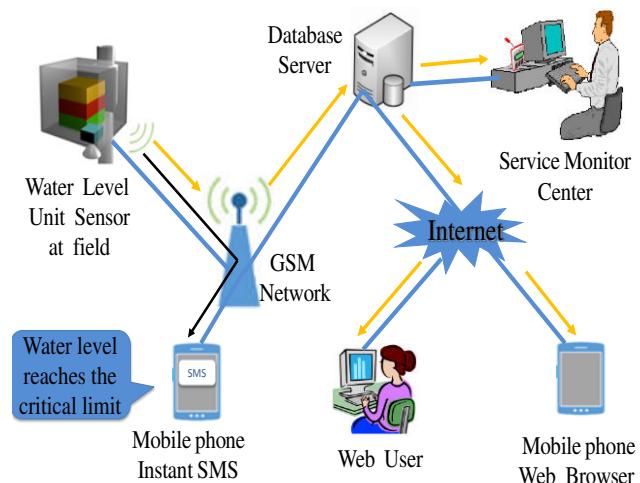


Fig 1.0: Designed System Block Diagram

To operate the designed system, interfacing and hardware configurations should be properly set to reach the desired goals. The system is divided into two constituents, field part and user part.

Field Part: To acquire data and transmitting, the following hardware are used, commercial ultrasonic level sensor is used to read the water level values and processing to the Arduino controller that commands GSM to send information to the database of the concerned authority.

User Part: River water level data gathered and sent by the GSM will be presented to the users through the web and mobile phone instant message.

4. SYSTEM DESIGN, SIMULATION AND RESULTS

The designed system is simulated by using Proteus 8 design suit software. Water level sensors will be distributed into different sites of the river, for this simulation, we have considered only one site, which is Ngara Site located at the Kagera River.

CASE 1: Water Level at Minimum Critical Point

In the design, the water level variations will be presented by auto variable voltage source which is connected to analog pin of ultrasonic sensor, and the Arduino will read the value received from the sensor, displayed on the Liquid Crystal Display (LCD) then sends the measurements to the central office for decision making through GSM Modem. Depending on the value of the water level, the LCD and GSM are processing the actual values. The minimum critical point in this simulation was set to all levels less than six metres. For instance if the water level decreases to the critical point the Arduino controller commands the GSM to send an alarm to an authority concern with environmental flow assessment. For the simulation purpose, an alarm is represented by the Light Emitting Diode (LED): Say, if the level drops to the critical point then the LED will switch ON for two minutes. The setup for an automated River Water Level Monitoring System based on Global System for Mobile Communication network when water level decreases up to the minimum critical point(< 6m) is shown in Fig. 2.

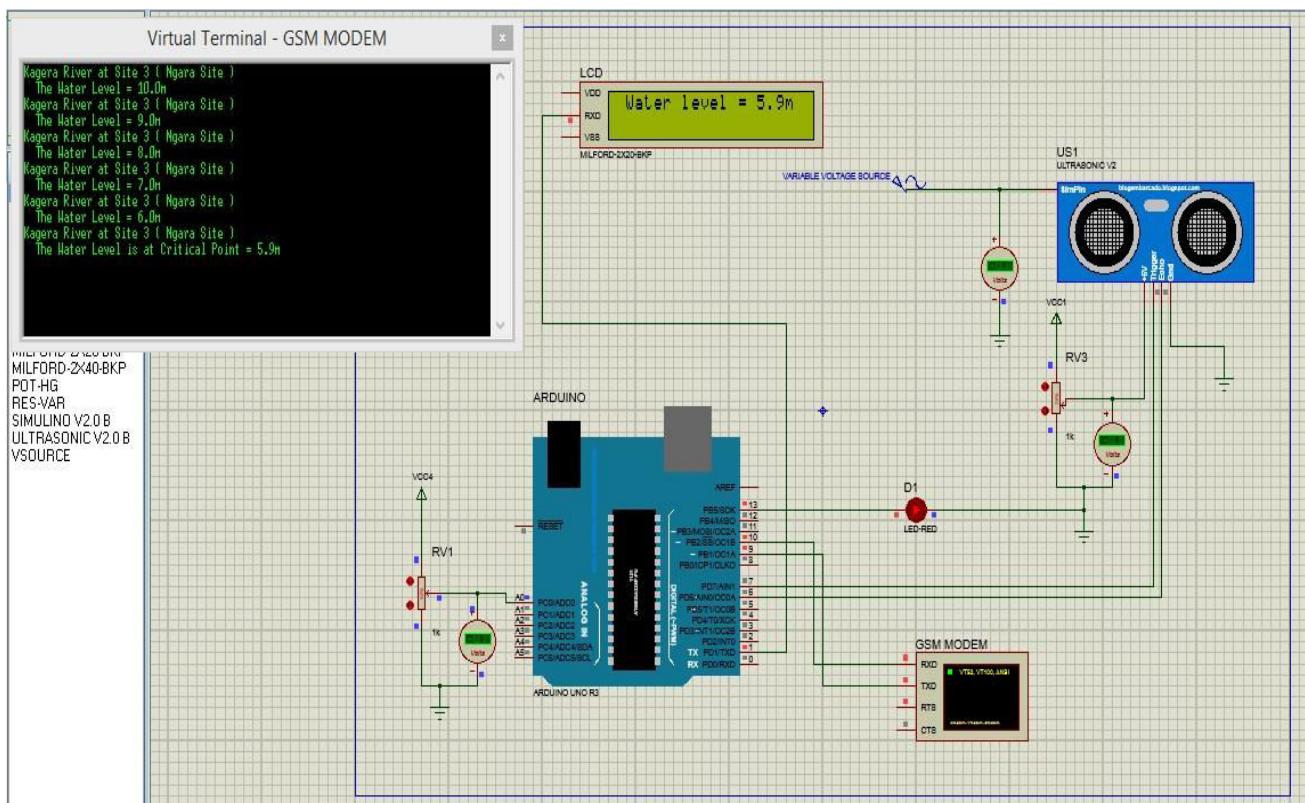


Fig. 2.0 Data Transmission Model between Ultrasonic Sensor, Arduino, Liquid Crystal Display and GSM Modem During water level decreasing to minimum critical point

CASE 2: Water Level at Maximum to Flooding Point

The flooding point in this simulation was set to all levels greater or equal 12m then the LCD will display the actual value while the Arduino is responsible for commanding the GSM to send information to the control unit on the water level status. If the water level $\geq 12\text{m}$, the LED is lighting, that is an alarm implying that the water level is about flooding so as measures should be taken. In the design, the water level of the river is varied through auto variable voltage source which is connected to analog pin of ultrasonic sensor. The Arduino part reads the signal value received from the sensor, displaying on the LCD then sends the

measurements to the master unit for decision making through GSM Modem. Regarding the real value of the water level, the LCD and GSM will be processing the actual values. Now if the water levels continue rising to the maximum point the Arduino controller will also continue to command the GSM to send an alarm to an authority concern with environmental flow assessment. For the simulation purpose, an alarm is represented by the LED. The setup for simulation of an automated River Water Level Monitoring System, based on GSM network when water level increasing up to the maximum point ($\geq 12\text{m}$) is shown in Fig. 3.

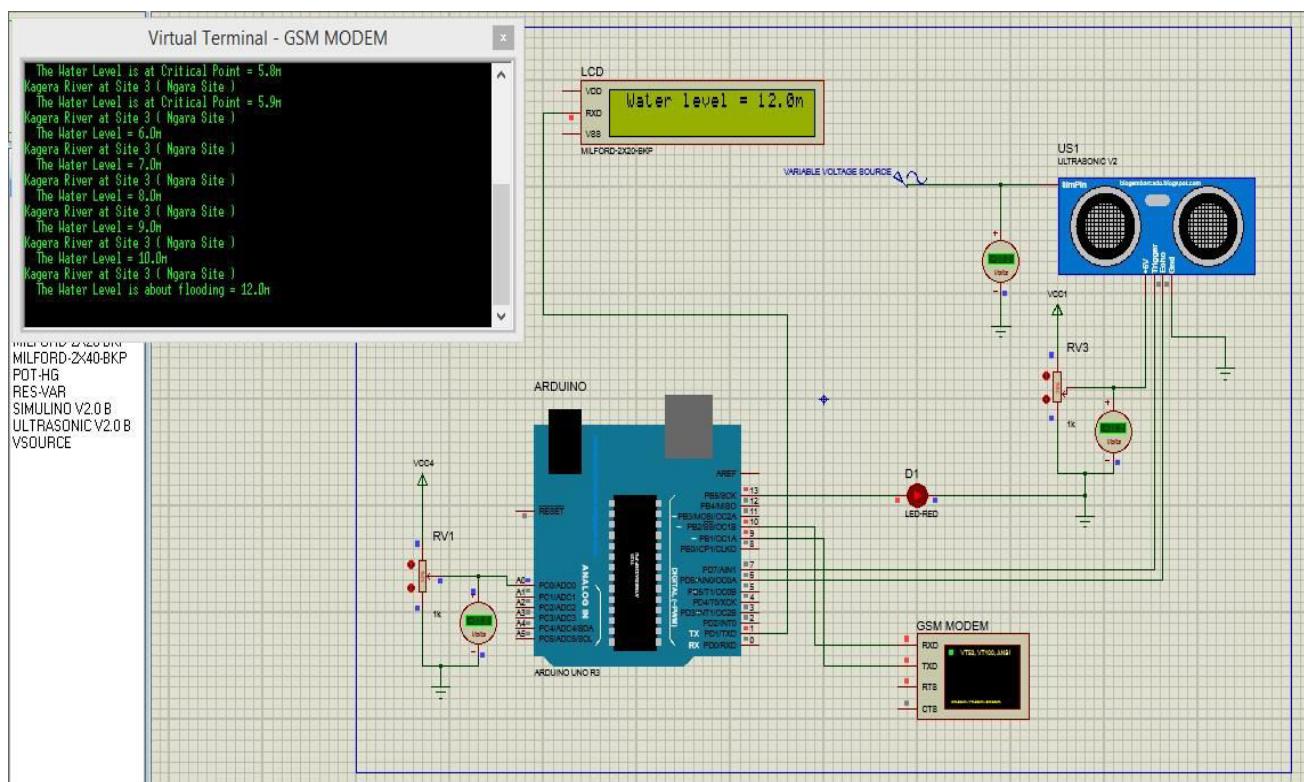


Fig. 3.0 Data Transmission Model between Ultrasonic Sensor, Arduino, Liquid Crystal Display and GSM Modem During water level increasing to flooding point

System Performance Requirements

Remote configuration: It should be possible to configure some parameters of the system remotely.
Event notification: The system has to allow notification in real-time if disruptive events occur.
Update Information: The system must allow new inquiry in order to attain current data.
Monitoring water level status: Monitoring the supplied water brings two major benefits, namely real-time analysis of the water level parameter and using the data to produce statistical reports.

User Requirements

Performance: The system has to be more accurate in measuring processing through ultrasonic sensor.
Flexibility: The system must be flexible in order to allow the user to insert, remove or edit parameters.
Usability: A friendly interface, flexible, with strong graphical capabilities, succinct and clear messages.
Power supply: In order to solve the problem of remote areas located in isolated places, with difficult access, and without power supply, the system needs to be equipped with a solar panel and a battery.

5. DISCUSSION

As the world's water resources become increasingly stressed, effective systems for management become more important. Several river water levels measuring systems for providing real time measurements to the concerned authorities with environmental flows assessment are available but most of them are relatively expensive. Therefore this paper presents the low cost river water level detection system to help the concerned authorities on getting river water level real-data. For an effective river water level control, detailed information must be available about the water level of the river. There is certainly a lack of available low cost systems for monitoring river water level to help during rain and dry season to estimate the required level to be left in the river for ecosystem survival. At the same time, control strategies have to be further developed to enable an effective management of the river water resource. A number of concepts for river water level detection systems have been introduced during the last decade and have been proven mainly by simulation studies. It is obvious that real time water level measurements in rivers environments like getting water level status and taking measures is still a challenging task which needs researchers to work hard so as to attain the solutions. According to the kind of river water level system used in our country "gauging stations" considerable innovations like the one presented by this paper are needed. Given the problems associated with the river water level, it is clear that delay in getting water level information could lead to the serious disaster. It is therefore of paramount importance that river water level assessment tools should be also developed and become an integrated part of operational control systems. Together with such tool, more advanced measurement system that can deliver key variables as certain water level parameters, will become acceptable for practical implementation and will deliver a boost in performance of the river water level control system.

6. CONCLUSION AND FUTURE WORK

The paper presented a proposed system with the aim of providing real-time river water level monitoring and warning response. The system employs the use of ultrasonic sensor, Arduino controller and GSM network in performing real-time monitoring of water information. The designed water level monitoring system is composed of three major components: 1) water level sensor, 2) processing and transmitting modules, and 3) database and application server. The connectivity is done through the GSM network. The ultrasonic sensor measures water level related data while the processing and transmission module is used to transmit measured data to the database and application server. The database and application server is implemented as a web-based application to allow users to view real-time water-related data as well as historical data. The designed system is also able to send warnings to the responsible authorities in case of emergency. It is evident that using this type of proposed system will have potential advantages in terms of time and cost saving. Through this system one can use it to indicate accessible and inaccessible roads to help commuters during critical scenarios. Our future work is to implement an automated river water level monitoring system by using the GSM networks and test in the real environment and evaluates its performance.

7. ACKNOWLEDGEMENTS

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ANALYSIS OF ICT APPLICATION IN MITIGATING LAND CONFLICTS: CASE STUDY OF TANZANIA

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Abstract—Land conflicts are common phenomena in Tanzania. They can be understood in the context of history, social relations and the process of commoditization of natural resources such as land and land resources.

One of the factors causing land conflicts is the poor land use planning and management. Tanzania has about 44.0 million hectares of arable land in Tanzania, but only 23% (about 10.5 million hectares) is being utilized,

In this study literature review is done to understand the context of land information management, then take a look at how land use plan is being practiced at district level and how ICT is applied in land use plan towards land conflicts mitigation. The study aims to analyze ICT potential role by identifying factors causing land conflicts that can be solved by ICT and establishing ways of mitigating the conflicts. This can be accomplished by integrating ICT in land use planning and management for easier inventory and allocation of land resource.

The study conclude that, implications of ICT for the land use management at district level have impact towards land conflicts mitigation, because ICT can enhance land administration through modern ways of keeping land information and can help policy and decision makers in reaching good decision making.

Keywords—Land Conflicts, Land use, Arable land, ICT, LIS, GIS, DBMS

I. INTRODUCTION

In the past two decades emergence of land conflicts has been increasing between different land users. Land conflicts cause negative impact to the society such as loss of lives and destruction of properties (IPPMEDIA, 2014). One of the factors causing land conflicts in Tanzania is poor land use planning and management (Mugabi, 2013), which may be associated with the use of inappropriate tools or technology to facilitate land records keeping. However Information Communication Technology (ICT) has the potential to overcome this among other factors and hence aid in mitigating land conflicts by the use of ICT tools such as Land Information System (LIS), Geographical Information system (GIS)

Currently, there is no LIS at district level in Tanzania to facilitate land management processes and activities. This cause difficulties in land management processes because of the complexity involved in the land management issues which eventually leads to land conflicts.

The recent land conflicts in Tanzania between different land users such as pastoralists and farmers have raised the need of applying ICT tools such as GIS and LIS for effective and efficient land administration and management. ICT is very useful especially where optimization in decision making is required. It is envisaged to be reliable tool for developing, planning and long run land programs. It will be a huge contribution to land offices at various levels i.e district, regional and national levels hence reducing land conflicts.

This study aims to analyse the potentials of ICT in mitigating land conflicts and state how ICT can play such role. Literatures indicate that this can be accomplished by integrating ICT in land administration and management and electronic inventory and allocation of land resource.

II. PROBLEM STATEMENT

There is no LIS for managing land information which results to poor land decisions such as double allocation of land leading to land conflicts and delaying of delivering land services to land stakeholders.

Main objective

The main objective of the study is to analyse the potential of ICT by identifying factors causing land conflicts and establishing ways of mitigating the conflicts.

Specific Objectives

Specific in this study;

- To identify factors causing land conflicts that can be solved by ICT.
- To analyse the role of ICT in mitigating land conflicts.

III. FACTORS CAUSING LAND CONFLICTS THAT CAN BE SOLVED BY ICT.

Land conflicts between different land users in Tanzania have been recurring for a long time claiming lives of many innocent people and creating major economic impacts to the nation. There are various factors that are causing land conflicts to persist that ICT can play part to solve them. These include the following.

- i. Inefficiency in delivering land services. This resulting to delaying in delivering land services. According to (Mwaikambo & Hagai, 2013),

general inefficiency of delivering core land functions is caused by the increased value for both land and land related properties as well as a fast growing population which increased high demand for land.

- ii. Double allocation of land is another factor causing land conflicts. This problem greatly exists as two or more people find to be claiming on plot of land each with a valid certificate right of occupancy (Mwashambwa, 2012). Double allocation is caused by poor management of land records.
- iii. Tanzania has total land area of 945,000 km² out of which only 11% has been registered with the legal administration (Mithofer, 2006). This may be associated with the use of inappropriate tools or technology to facilitate land registration. Land registration is important in reducing or avoiding land conflicts because it clears doubts that can arise over the real owner of a certain parcel of land and the conditions under that land. According to (McLaren & Stanley, 2011) land registration in many societies became customary to document the transfer of land rights in the form of legal deeds and certificates. To provide additional security, official copies of these records were kept in deeds registries, or what in some countries are called land books.
- iv. Land use planning refers to the process by which a society, through its institutions, decides where, within its territory, different socioeconomic activities such as agriculture, housing, industry, recreation, and commerce should take place. This includes protecting well-defined areas from development due to environmental, cultural, historical, or similar reasons, and establishing provisions that control the nature of development activities (World Bank, 2012). One of the factors that cause land conflicts in Tanzania is poor land use planning and management (Mugabi, 2013). This may also be related with the use of inappropriate tools in facilitating land use planning and records keeping.
- v. Poor decision making has been mentioned as one of the source of the land conflicts. MOST land use conflicts in Tanzania are caused and escalated by decisions and acts of the state through its various agencies (Haki ardhi, 2009). Many of the decision makers perform poorly due to lack of enough information. For instance village council may give the area to the investors without knowing that, the area has been demarcated for other uses for the interest of the village. This may cause conflicts between villagers and investors.

IV. THE ROLE OF ICT IN MITIGATING LAND CONFLICTS.

ICT has fundamental role in improving the operations of land administration and in making information services more available in support of urban and rural economic development and conflicts mitigation. ICT can have positive impacts in land administration by ensuring that its benefits reach many people by determining, recording, and disseminating information about various attributes of land. According to (UNECE, 2005), one of the benefit of good land administration system is that it reduces land disputes, therefore ICT can be seen as integral tool in reducing land conflicts.

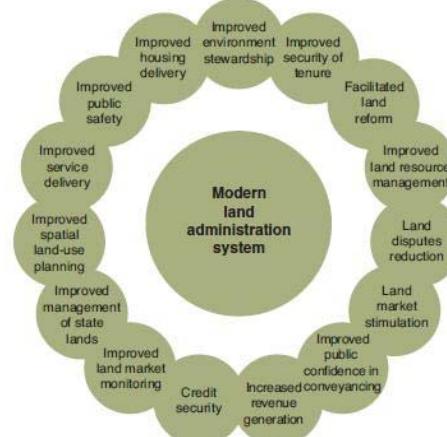


Figure 1. Benefits of good land administration. Source: adopted from (UNECE, 2005)

In Tanzania land records are still kept and processed in paper based way and only available in land offices at the district council. ICT significantly supports good governance in land administration by facilitating open, transparent access to land records for all (McLaren & Stanley, 2011). Therefore if ICT is well applied to the land information management it can provide transparency to the land records. Lack of transparency to the land records is one of the causes of land conflicts (Anna Locke, Giles Henley and Rugemeleza Nshala, 2013). ICT can enable land records to be accessed through mobile phones, either through web- or SMS-based information services. As the example from Indonesia indicates, ICT greatly improve the outreach of land administration services, especially for groups that were long excluded from such information hence increase transparency of the land information to the customer or key stakeholders (McLaren & Stanley, 2011).

Land tenure refers to the way in which land rights are held. Good land information systems can surpass customary land tenure systems by ensuring the security of land Tenure. According to (Matt McIntyre, 2010), tenure recording system has great role in reducing conflicts over land and its use for Pacific Island Countries & Territories (PICTs) provided that their specific needs are well addressed. For this to be achieved, information systems need to be enhanced to increase the knowledge base and provide a system of two-way communication between national governments and remote communities.

Poor land use planning and management is another problem facing many developing countries such as Tanzania and hence leading land conflicts. However ICT tools such as Database management systems (DBMS) and other sophisticated applications GIS and E-planning can be useful in keeping records and in helping planners to easily plan the uses of the land and towns.

ICT significantly support land use planning and management. In countries fortunate to have mature ICT infrastructures, governments have established e-planning portals that allow citizens to access land-use control information, including,

- Access to zoning development plans, planning regulations, and general land-use information.
 - Submission of development applications.
 - Access to proposed developments, associated drawings and their current status.
 - Access to the results of development control decisions.

avoid many land conflicts which would have happened if there was no E-planning system.

Mobile phones are also opening channels for citizen participation in the development control process and have significant potential to increase constituents' participation. For example, citizens can register for mobile phone alerts on specific types and/or locations of new development proposals and can text objections to development proposals to the planning authorities with associated authentication (McLaren 2010).

One of the major important component of any land administration system is a record of landownership. This is because of the uncertainties that can arise over who owns the land and under what conditions (McLaren & Stanley, 2011). Land registration is a process of official recording of rights in land through deeds or title (on properties). It means that there is an official record (the land register) of rights on land or of deeds concerning changes in the legal situation of defined units of land. It gives an answer to the questions “who” and

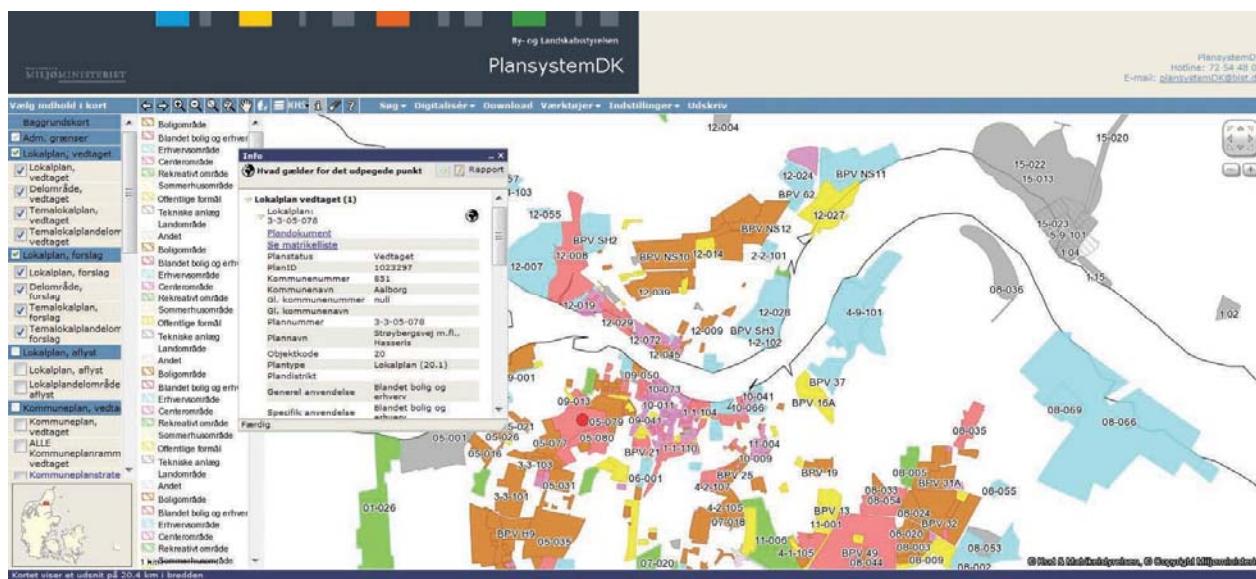


Figure 2. Example of E-Planning Portal. Source: adopted from (McLaren & Stanley, 2011).

E-planning portal is one of the most advanced portals in Denmark. The solution provides public access to all statutory land-use plans such as municipal plans and development plans (called a *lokalplan*), both adopted or proposed, across Denmark. The map-based interface provides a range of navigation tools, including address, cadastral parcel number, municipality, and area polygons. The areas of the development plans can be displayed in combination with cadastral maps, topographic maps, orthophotos and other kind of land use constraints, such as conservation areas and coastal protection zones (McLaren & Stanley, 2011). Citizens preparing to build or extend their house can use the system to determine what planning restrictions apply in their areas and hence reduce or

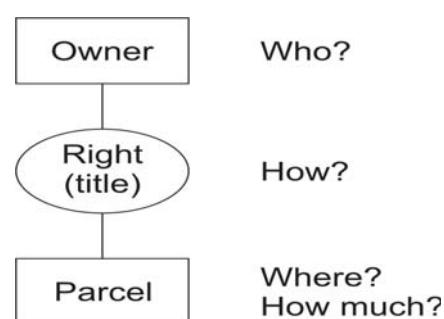


Figure 3. Core entities of land administration system. Source: adopted from (Zevenbergen, 2004) 2004).

As populations gradually increase in most societies, land become scarce resource and there are various types of rights to use the land developed. Hence registration is important to clarify ownership and minimize disputes, but also important for governments to collect property taxes. Without knowing the owner of the land and how that land is being used for, disputes may increase and governments cannot charge property taxes.

ICT significantly can facilitate land registration. Through the ICT land registration process can be easily implemented efficiently and effectively.

V. DISCUSSIONS

In Tanzania Land information are obtained from individual Institutions such as (N.G.Os, Survey companies, Researchers, district council), which collect them for their own purposes. Therefore it is difficult for the district particularly land office to use these information if critical decisions are to be made concerning land use plan and management, due to the fact that these information are not integrated with other aspects of social economic development. ICT has a crucial role to play in sharing and analyzing land information among agencies and in communicating and testing change scenarios with the citizens involved. The ICT has the potential to make land information available to the key customers or stakeholders, through internet or mobile phones which support internet access. This new channel bridging land administration services to a wider range of society many of whom are currently excluded (McLaren, 2010).

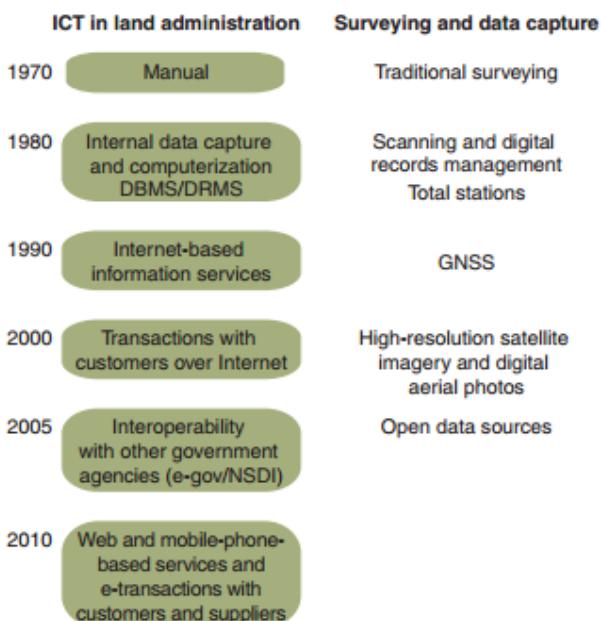


Figure 4. Evolution of ICT in Land Administration. Source: adopted from (McLaren & Stanley, 2011)

paper based method of handling land information at the land office in is still practiced at district level whereby when a customer come to ask for the information about specific land, land officer has to look for a flat file to search for the information and if the file is not found the customer is told to go and come back later after sometimes. The paper based method of handling land information brings a lot problems such as land conflicts but also the process is expensive and time consuming.

ICT tools such as GIS and LIS, provide the infrastructure for implementation of land policies and land management strategies and facilitate operations of the land registration, valuation and cadastre. It provide robust and secure repositories to manage the significant volumes of land information (textual and geospatial) in a distributed environment and to support efficient searching and querying of the information.

GIS efficiently store and retrieve raster scanned documents such as paper deeds. GIS supports the capture and editing of geospatial information such as parcel boundaries and interfaces to the land information repositories and wider national spatial data infrastructures (NSDI) to support spatial analysis and visualization, including a map-based interface for web information services.

The increased value for both land and land related properties as well as a fast growing population increased high demand for open access to land administration information and contributed to complexity in land management issues. This causes difficulties in handling different land allocations due to poor and conventional ways of keeping land information leading to inefficiency in delivering land services, example double allocation of the land resulting to land conflicts. LIS is an integral tool for effective and efficient land delivery services and hence reducing land conflicts. LIS can significantly support greater access to and sharing of information, improve data quality and completeness, increase security and transparency of operations and information increase revenue generation around new services, and provide a basis for monitoring and evaluation.

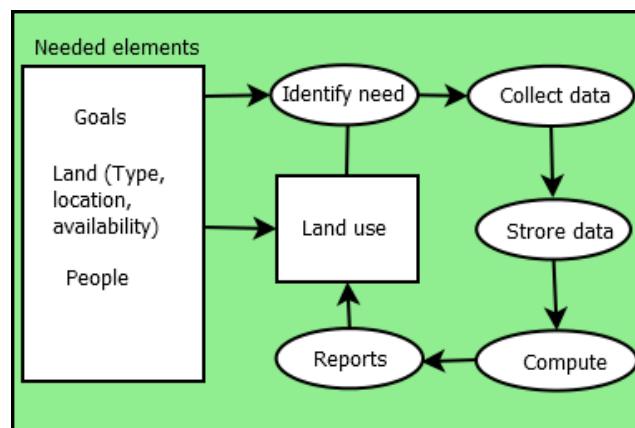


Figure 5. Land Information Management Link

LIS has tremendous value in land use planning and management in terms of ensuring the availability of land information for planning, analysis of growth and development trends, monitoring land resource and its uses. LIS can also lead policy and decision makers to reach the appropriate decisions for the benefits of the public which is vital in mitigating land conflicts.

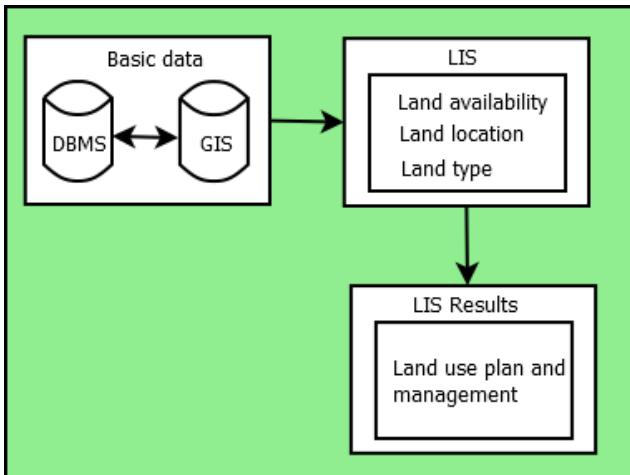


Figure 6. Decision support system pattern for land information management.

VI. CONCLUSION.

Absence or poor ICT in delivering land services is among the factors accelerating land conflicts. However many land conflicts can be solved when the use and importance of ICT technology such as Land Information System (LIS) and Geographical Information System (GIS) in land use planning and management will be recognized especially at district level.

Most of the operations that require land information, are continuous due to the fact that information need to be revised, updated and monitored continuously, it is very useful in tracking various issues of land use such as if there is land conflicts or possibility of conflicts to occur at certain places, this cannot be sustainable without proper land information system. LIS will also increase awareness concerning land issues to the planning officers, policy and decision makers as well as customers. This is a step ahead to efficient delivery of land services resulting to reduction of conflicts.

VII. RECOMMENDATIONS.

In order to ensure successful land conflicts mitigation by the use of ICT it is recommended that LIS to be introduced to the land offices at district level to improve efficiency delivering land services.

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Diplomatic Behavior of Big Data in Health Science

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Abstract:

Information are stored and used as data which is one of the most valuable resources for all purposes of further proceedings. High-quality information is used as sources for creation of knowledge and processing of various fields in science and technology. This information has great potential for impacting in human life and supports to the specific time by wider audiences and coalitions of stakeholders. Big data is a process of data collection, data organizing, and analyzing large sets of data to discover interesting patterns and other useful and meaningful information. Big data helps the organizations to provide better understand of the information contained within the data. It also helps to identify the data that is most important to the business and health science.

Keywords: Big data, Analytics, Healthcare, uniqueness, biomedicines.

I. Introduction:

Big data analytics basically want the *knowledge* that comes from analyzing the data. This analyzed data is used in the way for completely transforming our ability to understand the world and everything within it. This paper describes the diplomatic behavior of big data in the field of human health science. It discusses about the uniqueness of big data, big data models with its architecture, influences of big data in health issues, analysis of big data in drug development, its uses in biomedicine and it discusses the limitations of big data and its challenges with the following of conclusions.

II. Uniqueness of Big Data:

Big data has its own unique characteristics for its wide usages and it is given below:

- **Volume** – the greatest amounts of data generated every second
- **Velocity** – the speed at which new data is generated and moves around
- **Variety** – the increasingly different types of data
- **Veracity** – the messiness of the data
- **Value** - the data are become valuable

With these qualities big data got its effective growth in the health care area.

III. Influences of Big data in Health Issues:

The Influence of big data in the health science is constantly increasing for the foundational processes:

- **Collection and aggregation** of the big amounts of patient data produced from a variety of sources.
- **Analysis** - the collected data is analyzed for a variety of purposes for optimized patient care and business intelligence.
- **Applying** the analyzed data results to improve the effectiveness of patient care systems.

There are several factors that make the big data in the health science and health care. Those factors are given below:

- to focus better on value-based medicine
- to modify the medicine based on analytics
- to improve the clinical outcomes
- to increase the efficiency in managing data
- to improve the decision support
- in order to reduce pharmaceutical research costs
- to reduce the clinical testing costs

IV. Applications of Big data in Health care:

The usage of big data will improve the effectiveness of its operations on the areas of Clinical operations, Research & development and Public health. In addition, big data analytics in healthcare can contribute to Evidence-based medicine, Genomic

analytics, Pre-adjudication fraud analysis, Device/remote monitoring, Patient profile analytics. New methods are introduced by Big data with the combination of traditional structured data and unstructured internal and external data sources. It will provide rapid, valuable effort for improving organizational performance and population health. Many healthcare organizations use this big data to extract knowledge and insight from this raw data, and integrate those insights into business processes. Hence these services help healthcare and life sciences organizations develop effective and actionable.

V. Analysis of Big data in drug Development:

The process of drug development is highly difficult and its cost is too high. The development costs are increased in the way of costs larger than clinical trial sizes and higher failure rates for drugs specimen testing. The big data is used in the drug development, with the patient's genome, epigenome, proteome, metabolome, and micro biome. For the disease treatment, suitability of medicine initiatives are being undertaken and development process is used to develop the targeted therapies and selection strategies with the potential.

With the Big data, it could be done as data-driven drug development process. Here the data are enabled by the help of Data modeling, data mining, and machine learning. The technique of Machine learning enables computers to recognize and learn patterns in data for use in future predictions. It will be at the forefront of Big Data analytics due to its ability to solve the types of complex

problems inherent in human biology and drug response. Supervised machine learning approaches that use sophisticated mathematical algorithms to optimize complex predictor functions on a predefined outcome can be used to reduce Big Data to a more manageable set of biomarker candidates, or “features.” Tools that take an ensemble approach may lead to discovery of different types of effects, which is a worthy consideration when attempting to understand human biology.

In the way of Machine learning techniques big data have improved ability over traditional statistics. It discover the complex signals underlying human biological response to drugs through collectively and evaluating this system by naturally grouping variables and extracting patterns according to biologically relevant units of variations, signaling pathways, or gene regulatory networks.

VI. Uses in Biomedicines:

Biomedicine is a branch of medical science that applies in both biological and natural-science principles for medical practice. The branch especially applies to biology and physiology. This Biomedicine can also relate in too many categories in health and biological related fields. It is the dominant health system for more than a century. In connection with big data the survival of biomedicines is huge range. It is possible with the recent development of database, data storage, data capturing. This helps in patient monitoring and sensor technologies via the huge medical and health data generation at hospitals and medical organizations with tremendous speed. This valuable resource of data used for

improving the health care and decision making and better risk analysis and diagnosis.

By this way the big data is used in Bio medicinal field by Medical data capturing via data integration, data mining and data analysis. It is used to drive better health delivery. The application of data analytics is used to improve health care performance.

VII. Limitations of Big data and its Challenges:

There is lots of collection of data available but there are no approaches for centralizing the information. According to a recent survey there are several disparate systems for gathering data, but not for managing log data. The right analytics tools can definitely help to streamline and make sense of all this data, but a well-conceived strategy for collating data sources from different silos is still necessary. There could be a high risk in getting the right information into the hands of decision makers. It's the fact that too many companies be deficient in consistent approaches to utilize the gushers of customer and business data that are flowing into their organizations. Whenever the as data is gathered, it needs to be mapped out. In addition, critical data needs to be separated from insignificant or unnecessary data.

Still there is a need of right analytics tools to help data scientists and business leaders for making the sense of the volumes of data that are driving into their organizations. Since there is a shortage in both Big data skills and also data scientists in the market. This gives the information about the shortage of people who know how to work well with

large volumes of data and big data sets. There is a huge need in companies for the people to work with the data streams that are coming into their organizations. There is a lack for data scientists for applying predictive analytics to big data with a right skill set of knowledge.

VII. Tools Used in Big data Analytics:

There are several tools in the market for the use of big data analytics. Here I have given the names of some tools used for the best purposes. Splice machine, Google charts, MarkLogic, SAP in memory, MongoDB, Cambridge semantics, Pentaho, Talend , Tableau, Splunk. These are the tools which include products for developing, testing and deploying data management and application integration products. These tools have the key features of combining data from multiple sources and customized dashboards to make analysis easy.

IX. Conclusions:

By this analysis, we frame an idea about how the big data analytics makes the probable ways to transform the health care providers for the current technologies to gain their clinical and other data repositories and make informed decisions. The several challenges highlighted above, must be over come in future. The issues like guaranteeing privacy, safeguarding security should be cleared in near future. At the same time the improving tools and technologies of big data will have greater attention. Big data analytics and applications in healthcare are at a recent stage of development, but rapid

advances in platforms and tools can accelerate their maturing process. Big data analytics in healthcare is evolving into a promising field for providing insight from very large data sets and improving outcomes while reducing costs. Its potential is great; however there remain challenges to overcome. We can expect a tremendous improvement in business sectors, medical fields, and bio technology and bio medicines with the influence of big data in right future.

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Track A: Security

Access control, Anonymity, Audit and audit reduction & Authentication and authorization, Applied cryptography, Cryptanalysis, Digital Signatures, Biometric security, Boundary control devices, Certification and accreditation, Cross-layer design for security, Security & Network Management, Data and system integrity, Database security, Defensive information warfare, Denial of service protection, Intrusion Detection, Anti-malware, Distributed systems security, Electronic commerce, E-mail security, Spam, Phishing, E-mail fraud, Virus, worms, Trojan Protection, Grid security, Information hiding and watermarking & Information survivability, Insider threat protection, Integrity
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Location Anonymity schemes, Intrusion detection and prevention techniques, Cryptography, encryption algorithms and Key management schemes, Secure routing schemes, Secure neighbor discovery and localization, Trust establishment and maintenance, Confidentiality and data integrity, Security architectures, deployments and solutions, Emerging threats to cloud-based services, Security model for new services, Cloud-aware web service security, Information hiding in Cloud Computing, Securing distributed data storage in cloud, Security, privacy and trust in mobile computing systems and applications, **Middleware security & Security features:** middleware software is an asset on

its own and has to be protected, interaction between security-specific and other middleware features, e.g., context-awareness, **Middleware-level security monitoring and measurement:** metrics and mechanisms for quantification and evaluation of security enforced by the middleware, **Security co-design:** trade-off and co-design between application-based and middleware-based security, **Policy-based management:** innovative support for policy-based definition and enforcement of security concerns, **Identification and authentication mechanisms:** Means to capture application specific constraints in defining and enforcing access control rules, **Middleware-oriented security patterns:** identification of patterns for sound, reusable security, **Security in aspect-based middleware:** mechanisms for isolating and enforcing security aspects, **Security in agent-based platforms:** protection for mobile code and platforms, Smart Devices: Biometrics, National ID cards, Embedded Systems Security and TPMs, RFID Systems Security, Smart Card Security, Pervasive Systems: Digital Rights Management (DRM) in pervasive environments, Intrusion Detection and Information Filtering, Localization Systems Security (Tracking of People and Goods), Mobile Commerce Security, Privacy Enhancing Technologies, Security Protocols (for Identification and Authentication, Confidentiality and Privacy, and Integrity), Ubiquitous Networks: Ad Hoc Networks Security, Delay-Tolerant Network Security, Domestic Network Security, Peer-to-Peer Networks Security, Security Issues in Mobile and Ubiquitous Networks, Security of GSM/GPRS/UMTS Systems, Sensor Networks Security, Vehicular Network Security, Wireless Communication Security: Bluetooth, NFC, WiFi, WiMAX, WiMedia, others

This Track will emphasize the design, implementation, management and applications of computer communications, networks and services. Topics of mostly theoretical nature are also welcome, provided there is clear practical potential in applying the results of such work.

Track B: Computer Science

Broadband wireless technologies: LTE, WiMAX, WiRAN, HSDPA, HSUPA, Resource allocation and interference management, Quality of service and scheduling methods, Capacity planning and dimensioning, Cross-layer design and Physical layer based issue, Interworking architecture and interoperability, Relay assisted and cooperative communications, Location and provisioning and mobility management, Call admission and flow/congestion control, Performance optimization, Channel capacity modeling and analysis, Middleware Issues: Event-based, publish/subscribe, and message-oriented middleware, Reconfigurable, adaptable, and reflective middleware approaches, Middleware solutions for reliability, fault tolerance, and quality-of-service, Scalability of middleware, Context-aware middleware, Autonomic and self-managing middleware, Evaluation techniques for middleware solutions, Formal methods and tools for designing, verifying, and evaluating, middleware, Software engineering techniques for middleware, Service oriented middleware, Agent-based middleware, Security middleware, Network Applications: Network-based automation, Cloud applications, Ubiquitous and pervasive applications, Collaborative applications, RFID and sensor network applications, Mobile applications, Smart home applications, Infrastructure monitoring and control applications, Remote health monitoring, GPS and location-based applications, Networked vehicles applications, Alert applications, Embedded Computer System, Advanced Control Systems, and Intelligent Control : Advanced control and measurement, computer and microprocessor-based control, signal processing, estimation and identification techniques, application specific IC's, nonlinear and adaptive control, optimal and robot control, intelligent control, evolutionary computing, and intelligent systems, instrumentation subject to critical conditions, automotive, marine and aero-space control and all other control applications, Intelligent Control System, Wiring/Wireless Sensor, Signal Control System. Sensors, Actuators and Systems Integration : Intelligent sensors and actuators, multisensor fusion, sensor array and multi-channel processing, micro/nano technology, microsensors and microactuators, instrumentation electronics, MEMS and system integration, wireless sensor, Network Sensor, Hybrid

Sensor, Distributed Sensor Networks. Signal and Image Processing : Digital signal processing theory, methods, DSP implementation, speech processing, image and multidimensional signal processing, Image analysis and processing, Image and Multimedia applications, Real-time multimedia signal processing, Computer vision, Emerging signal processing areas, Remote Sensing, Signal processing in education. Industrial Informatics: Industrial applications of neural networks, fuzzy algorithms, Neuro-Fuzzy application, bioInformatics, real-time computer control, real-time information systems, human-machine interfaces, CAD/CAM/CAT/CIM, virtual reality, industrial communications, flexible manufacturing systems, industrial automated process, Data Storage Management, Harddisk control, Supply Chain Management, Logistics applications, Power plant automation, Drives automation. Information Technology, Management of Information System : Management information systems, Information Management, Nursing information management, Information System, Information Technology and their application, Data retrieval, Data Base Management, Decision analysis methods, Information processing, Operations research, E-Business, E-Commerce, E-Government, Computer Business, Security and risk management, Medical imaging, Biotechnology, Bio-Medicine, Computer-based information systems in health care, Changing Access to Patient Information, Healthcare Management Information Technology. Communication/Computer Network, Transportation Application : On-board diagnostics, Active safety systems, Communication systems, Wireless technology, Communication application, Navigation and Guidance, Vision-based applications, Speech interface, Sensor fusion, Networking theory and technologies, Transportation information, Autonomous vehicle, Vehicle application of affective computing, Advance Computing technology and their application : Broadband and intelligent networks, Data Mining, Data fusion, Computational intelligence, Information and data security, Information indexing and retrieval, Information processing, Information systems and applications, Internet applications and performances, Knowledge based systems, Knowledge management, Software Engineering, Decision making, Mobile networks and services, Network management and services, Neural Network, Fuzzy logics, Neuro-Fuzzy, Expert approaches, Innovation Technology and Management : Innovation and product development, Emerging advances in business and its applications, Creativity in Internet management and retailing, B2B and B2C management, Electronic transceiver device for Retail Marketing Industries, Facilities planning and management, Innovative pervasive computing applications, Programming paradigms for pervasive systems, Software evolution and maintenance in pervasive systems, Middleware services and agent technologies, Adaptive, autonomic and context-aware computing, Mobile/Wireless computing systems and services in pervasive computing, Energy-efficient and green pervasive computing, Communication architectures for pervasive computing, Ad hoc networks for pervasive communications, Pervasive opportunistic communications and applications, Enabling technologies for pervasive systems (e.g., wireless BAN, PAN), Positioning and tracking technologies, Sensors and RFID in pervasive systems, Multimodal sensing and context for pervasive applications, Pervasive sensing, perception and semantic interpretation, Smart devices and intelligent environments, Trust, security and privacy issues in pervasive systems, User interfaces and interaction models, Virtual immersive communications, Wearable computers, Standards and interfaces for pervasive computing environments, Social and economic models for pervasive systems, Active and Programmable Networks, Ad Hoc & Sensor Network, Congestion and/or Flow Control, Content Distribution, Grid Networking, High-speed Network Architectures, Internet Services and Applications, Optical Networks, Mobile and Wireless Networks, Network Modeling and Simulation, Multicast, Multimedia Communications, Network Control and Management, Network Protocols, Network Performance, Network Measurement, Peer to Peer and Overlay Networks, Quality of Service and Quality of Experience, Ubiquitous Networks, Crosscutting Themes – Internet Technologies, Infrastructure, Services and Applications; Open Source Tools, Open Models and Architectures; Security, Privacy and Trust; Navigation Systems, Location Based Services; Social Networks and Online Communities; ICT Convergence, Digital Economy and Digital Divide, Neural Networks, Pattern Recognition, Computer Vision, Advanced Computing Architectures and New Programming Models, Visualization and Virtual Reality as Applied to Computational Science, Computer Architecture and Embedded Systems, Technology in Education, Theoretical Computer Science, Computing Ethics, Computing Practices & Applications

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